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**CEMENT-MILL
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Read in
Largest Number
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No. 8

Awards for Concrete Roads Exceed 1930

STREET CONTRACTS DECLINED

Contracts awarded for concrete highway construction in the United States during 1931 totaled about 112,000,000 sq. yd. against 108,008,062 sq. yd. awarded in 1930, according to the Portland Cement Assn. For the first 11 months this year highway awards totaled 108,089,955 sq. yd.

Although final figures are not yet available, there was approximately 102,000,000 sq. yd. of concrete highway paving actually laid during the year, of which about 26,600,000 sq. yd. represent unfinished work carried over from 1930. The pavement laid in 1931 when based on an 18-ft. width, amounts to about 11,340 miles as compared with 10,500 miles last year.

Awards for concrete street and alley paving in 1931 were 22,134,000 sq. yd. awarded during the first 11 months. This compares with 37,813,593 sq. yd. for the full year 1930. This decline of about 15,500,000 sq. yd. in municipal work places the combined total of highway, street and alley paving down to approximately 134,000,000 sq. yd. against 145,821,625 last year. Financial difficulties of several large cities account for the shrinkage in municipal paving contracts, which in turn accounts for the decrease in total concrete paving awarded.

Awards Silicosis Victim \$10,000 in Damage Suit

Charles Clouse of Wedron, Ill., was awarded \$10,000 damages recently by a circuit court jury as the result of a suit in which he alleged that he had contracted silicosis during his employment with the Wedron Silica Sand Co.

The suit is the first ever prosecuted under the workmen's compensation law in Illinois involving the disease.

Sand-Lime Brick Assn. Postpones 1931 Meeting

With the consent of the Executive Committee the 28th annual meeting of the Sand-Lime Brick Assn., which was to have been held in Washington February 3 and 4, has been put over until later on in the year. Officers plan on

preparing their reports which will be submitted to the Executive Committee for their approval and mailed to all of the members some time during February.

On account of the changed conditions in building some manufacturers have installed equipment to make block, tile and larger size brick of sand and lime, and this feature will be included in the reports of the association's activities.

Initial Blast Fired at New Washington Quarry

The initial blast in the quarry recently opened near Fishers, Wash., by the Columbia Contracting Co., was detonated late in December. Six well drills are being continuously employed preliminary to the blasting, which is to continue throughout the winter and spring. Approximately 700,000 tons of material are to be quarried in fulfilling a government contract. About 60 cars of material will be loaded daily, according to present schedules.

Freight-Rate Increase Into Effect January 4

Increased freight rates, allowed by the Interstate Commerce Commission in its recent amended decision in Ex Parte 103, went into effect January 4, 1932. The increases, varying from 6 to 12 c. per ton, affect most of the nonmetallic minerals, including sand, gravel, stone, slag, phosphate rock, asphalt and sulphur.

Acquires Stone Deposit in U. S. Forest Reserve

Ouachita Quarries, of Little Rock, Ark., has secured over 1,500 acres of limestone deposits in the Ouachita National Forest, Montgomery County in Arkansas. The company plans installation shortly of quarrying, conveying, and other equipment.

Alabama Lime Producer Gets 150,000-Bbl. Order

The Superior Lime & Hydrate Co., of Pelham, Ala., has received an order for 75,000 bbl. of hydrate for purification of water for the city of New Orleans, and 75,000 bbl. of lime for the Gulf States Paper Co., of Tuscaloosa.

Plan Entertainment for 1932 Convention

FEATURES ON S. & G. PROGRAM

Entertainment features at the convention of National Sand & Gravel Assn. convention at Pittsburgh, January 27-29 will keep the delegates and women guests busy. A number of delightful events have been arranged by the Western Pennsylvania Sand and Gravel Assn.

Wednesday evening, January 27, is to be known as Pittsburgh night. Starting at 8:15 in the ballroom, seventeenth floor of the William Penn Hotel, amateur boxers will appear in six bouts, with the approval of the state athletic commission. All ladies present at the convention are expected to accompany their male escorts to this affair. While no ring-side seats are to be given out in advance, every effort will be made to provide seats which will expose every blow. Following the boxing bouts a buffet luncheon will be served in the ballroom.

On Thursday evening the annual banquet will be held. Dancing will start immediately afterward to the rhythmic strains of Dannie Nirella's eleven-piece orchestra.

While the men are attending the business sessions, the ladies will not be neglected. Early Wednesday morning there will be a meeting for acquaintance in the Adonis room of the hotel. Following this, luncheon will be served in the same room. Then, the ladies will adjourn to one of Pittsburgh's theatres.

On Thursday, the ladies are booked for a 20-mile drive to the delightful suburban home of Mrs. Ralph Dravo in Sewickley Heights where luncheon will be served and a reading delivered by Mrs. Mary Jones Sherrill. On the return trip Pittsburgh's "golden triangle" will be exposed from the peaks of Mt. Washington, one of the city's larger hillsides.

Friday, January 29, is an open date for the ladies. Inspection trips will be arranged of Pittsburgh's industrial plants. Heinz's fifty-seven varieties of food may be sampled by those wishing to view the sanitary kitchens of this nationally-known institution. Likewise other plants will be open for inspection by those present at the convention.

Tell of Achievements in Highway Research

COUNCIL IN ANNUAL MEETING

Scientists, who devote their efforts to solving problems in road construction, and practical engineers who try to apply the scientific information to best effect attended the eleventh annual meeting of the highway research board, division of the National Research Council, in Washington on December 10 and 11. The sessions were held at the National Academy of Sciences, with a banquet at the Hotel Willard as the chief social feature.

While many subjects were taken up bearing on road materials, bridge construction, causes of deterioration in roads, a distinct feature was a report on steel reinforcement in concrete pavements and paving bases. This was the combined work of C. A. Hogenotger, F. A. Robeson and E. A. Willis of the division of tests, United States Bureau of Public Roads.

Benefits from reinforcement, they said, were established in a report six years ago, but the convincing causes have required this later study.

This latest investigation, the report says, "has indicated more and more that some of the benefits furnished by reinforcement are due to the influence it exerts upon the internal stresses and other factors which affect the strength and durability of concrete.

Some of these intricate effects were summarized as follows:

"The concrete may shrink due to loss of moisture and solution of cement constituents; after hardening it may swell due to moisture absorption; may shrink due to moisture loss; may expand due to rising temperature; may contract due to drop in temperature; may warp due to temperature or moisture content in the tops of the slabs differing from those in the bottom of the slabs; may distort due to non-uniform subgrade support; may deflect due to traffic loads, and finally, may be subjected to the disintegrating influence of frost or other detrimental physical or chemical action."

Frost effects, it was shown in a report by Verne McCown, of the United States Bureau of Public Roads, have a relation to the water-cement ratio used. He pointed out there has been a tendency in some localities toward decreasing the amount of cement in concrete for highway use. This was deplored. The skimping, it was argued, grew out of the reliance on hardness as a test, when durability and permanent strength in highway use depends upon the avoidance of any skimping. McCown presented a great deal of data giving road engineers a new slant on the importance of sufficient cement to insure permanence, minimum maintenance and the best results.

The importance of a sand-and-tar "cushion" for brick or block paving

was conceded by J. S. Crandell, professor of highway engineering at the University of Illinois, who reported on the various methods used to bind the sand.

On the general subject of bridge design reports were made on concrete, steel and timber. The merits of concrete were set forth by E. M. Fleming of the Portland Cement Assn.

George E. Hamlin of the Connecticut State Highway Department was chosen chairman of the board for the coming year, with A. T. Goldbeck of Washington as vice-chairman. R. W. Crum, the director, continues in that position. In each state the board has a "contact man" and about twenty scientific and industrial organizations have assigned members of the board. The executive committee includes, besides Hamlin, H. C. Dickinson and T. R. Agg.

Superior Cement Plant Closes After Long Run

After ten years of practically continuous operation, twenty-four hours a day, the plant of the Superior Portland Cement, Inc., at Concrete, Wash., has been closed down.

During the shutdown all machinery and equipment will be given a general overhauling, and many needed repairs and alterations made. Full advantage will be taken of the closed period to have everything in excellent condition for another long run when operations are resumed.

The last time the plant was shut down, except for an occasional day, was in 1921, when the mills were closed a few weeks during the holidays. Prior to that time it had been the custom to close down every winter for a period ranging from two weeks to two months for overhauling and repairs. Since 1921 it has been necessary to operate steadily the year around to keep enough cement on hand to fill orders. The company now has considerable stocks on hand.

Work will be resumed before spring, however, according to company officials.

Associated Contractors to Gather at Milwaukee

The thirteenth annual convention of the Associated General Contractors of America will be held in Milwaukee, with headquarters at the Schroeder Hotel, January 18 and 21, 1932. President A. P. Greensfelder of St. Louis, will preside.

The intensive work of the association, with its headquarters staff at Washington, D. C., will be reviewed. Combined problems of normal and abnormal times will receive their impetus at the several sessions and started on the way to improving the construction industry. The association has been active in credit reform work, safety and skill among workmen, promoting free labor as against convict labor, establishing a Bureau of

Contract Information and furthering interests of the responsible contractor. It has joined hands with other national associations in the industry and is now prominent in the work of assisting and developing the Construction League of the United States which will act readily as a clearing house for the industry at Washington, D. C.

Milwaukee will attract members of the Association from all parts of the country. Speakers of national prominence and leaders in the industry and its related workings will be on the convention program. President Arthur Bentley of the Milwaukee chapter has twelve committees serving to promote and entertain the delegates as well as their wives, sons and daughters. The leading industries of Milwaukee and the business men as well are lending their support to assure a successful convention and a most enjoyable time for all.

Shelter, Food Provided Idle Men by Cement Co.

Idle employees of the Missouri Portland Cement Co. at St. Louis, laid off on account of curtailed production, have been assured of shelter and food during their period of unemployment. H. L. Block, president, announced recently that 195 men and their families would be permitted to live in company-owned houses without paying rent and that fuel and food would be supplied at cost, not to be paid for, however, until the men are again employed.

Ohio River Pilot Dies After Colorful Career

Capt. Charles McNutt, 61, veteran steamboat captain on the Ohio River, and, during the last 14 years, chief pilot for the Bedford-Nugent Sand & Gravel Co. of Evansville, Ill., died recently at his home in Evansville. Death was due to pneumonia. Capt. McNutt had devoted his entire life to work on the river. In the early days of his colorful career he operated passenger packets and before becoming associated with the Bedford-Nugent company had directed the movement of river vessels for the Evansville Sand & Gravel Co.

North American Cement Wins Freight-Rate Case

The North American Cement Corp. scored a victory in its rate fight against the Baltimore & Ohio Railroad and the Pennsylvania Railroad. The Interstate Commerce Commission, as a result of the complaint, has ordered the railroads to establish on or before March 10, 1932, a freight rate on cement compound from Berkeley, W. Va., to Chicago, that shall not exceed 25 per cent. of the contemporaneous first-class rate, subject to carload minimum weight not in excess of 50,000 lb.

The cement compound referred to is a cement floor or building compound, and the commission points out that it usually sells for less than 2 c. per lb. This puts it, the commission finds, in an entirely different class from cement-waterproofing compound selling for 10 c.

Cement Company Chorus Sings Christmas Carols

Organized among members of the Chicago office of the Universal Atlas Cement Co., a sixty-voice mixed chorus was a feature of business men's meetings in the Chicago loop during the holiday season. In addition, a radio appearance was made over station WMAQ on Wednesday, December 23, which drew favorable comments from many listeners.

The chorus, organized in 1928 by B. F. Affleck, president of the company, annually sings carols on Christmas Eve in the corridors of the building where the company's Chicago offices are located. Thus it not only provides a pleasant activity for the singers, but also helps to spread Christmas cheer among all members of the organization, and others who hear its programs.

New Operator Develops Lime Deposit in Idaho

The Banks Lime & Mineral Products Co., of Boise, Ida., has started operations at its recently-leased deposit of calcium carbonate at Banks, Ida. The property is owned by the American Mines Development Co.

The deposit, it is said, tests from 97 to 99 per cent. pure calcium carbonate and machinery to produce poultry grits, stock mineral and agricultural lime will be installed. Other lime products will also be produced, it is announced.

A. R. Masters, Boise, is president and general manager and John Marchetti is superintendent in charge of operations at Banks.

Lake Cement Carrier in Port for Winter Months

The steamer *J. B. John* of the Petoskey Transportation Co., subsidiary of the Petoskey Portland Cement Co., has gone into winter quarters in the port of Harbor Springs, Mich. The steamer is used to transport cement from the company's plant at Petoskey during the navigation season.

Develops New Cement for Use as Interior Finish

Development of a new cement has been announced by Dr. Howard S. Lukens of the University of Pennsylvania chemistry department. The cement, which is said to be suitable only for interior work, being subject to disintegration when exposed to the weather, develops an extremely high

tensile strength and becomes "as hard as granite," according to press reports, as soon as it becomes cured. The new cement is a combination of magnesium oxide and magnesium chloride and Dr. Lukens has been experimenting with it in different chemical combinations for the past six years, it is reported. Possibilities for the material as a wall-finishing material are said to be great, since it has all the qualities of plaster and great tensile strength as well.

Lehigh Cement Resumes Work at Mitchell Mill

Operations at the Mitchell, Ind., plant of the Lehigh Portland Cement Co. were resumed on January 4, according to an announcement made by W. H. Weitknecht, superintendent, who also declared that the plant will possibly operate throughout the remainder of the winter. The Mitchell plant was among those favored in the recent awards made by the Indiana State Highway Department for cement to be used in road work in 1932. The allotment for the Mitchell plant was placed at 33,000 bbl.

Another Concern Enters Silica Field at Ottawa

Another company entered the silica-sand business in the well-known Ottawa, Ill., district recently when the Aetna Sand & Gravel Co. of Chicago completed negotiations for the acquisition of a silica deposit near that city. It is understood that the construction of a plant for processing the sand is soon to be started. The property acquired by the Aetna company adjoins that of the Libby-Owens-Ford Glass Co. and the Ottawa Silica Co.

The Aetna company at present operates sand pits and plants at Algonquin, Ill., Sawyer, Mich., and Chrisman and Michigan City, Ind.

Oregon Producer Sells Sand-and-Gravel Plant

Roy Wilcox, owner of the Wilcox Sand & Gravel Co. of Grants Pass, Ore., has sold the company to P. P. Proctor and C. A. Swope, both of Grants Pass. While the purchase price of the plant was not divulged, Mr. Wilcox' invoice price on the plant in January, 1931, was \$65,000. The establishment is located on the Rogue river, and is adjacent to the C. & O. C. Railroad.

Build New Crushed-Stone Plant Near Upland, Cal.

Construction of a \$10,500 crushed-stone plant has been started near Upland, Cal., by the Southern California Rock Co. D. L. Holliday, president and general manager, is superintending the work of erection and operations are scheduled to begin before February 1.

How a Lime Producer Entered Paint Field

SOLVED OWN PROBLEM FIRST

The Diamond Springs Lime Co., of Diamond Springs, Cal., is one of an increasing number of nonmetallic-mineral producers which believes that a plant should not only operate satisfactorily but should also look well. When this company erected its plant several years ago everything was built of concrete and steel. It was then also decided to paint all of the machinery with an aluminum finish. In carrying out this program the problem presented itself of finding an aluminum paint which would adhere to the kilns and stacks, which are operated under extremely high temperatures.

Extensive inquiry among paint manufacturers disclosed the fact that such a paint could not be obtained. However, the lime company's officials were still determined to have the kilns and stacks painted aluminum, so the chemistry department was put to work on the problem of developing a paint that would withstand the extremely high temperatures which would be encountered. Their efforts were rewarded and the kilns and stacks as well as the other machinery about the plant have been painted with an aluminum paint which has withstood the extreme temperatures and the natural elements for more than two years.

The remarkable results obtained brought numerous requests from individuals and other companies for information as to where this paint could be purchased. In order to meet the increasing demand the El Dorado Chemical Co. was formed as a subsidiary of the Diamond Springs Lime Co. for the purpose of manufacturing it for the market.

Gray Amalga is a ready-mixed paint manufactured by the El Dorado Chemical Co., and is designed to be used as a protective coating over metal to prevent the formation of rust and corrosion, and also as a base-coat paint for use under Hi-Tem-Al, a heat-resisting aluminum paint.

Hi-Tem-Al heat-resisting aluminum paint is designed for use where extreme heat conditions prevail; it is also said to be superior for ordinary use, as the Hi-Tem-Al vehicle does not cause the aluminum powder to discolor with age, according to the company. When properly applied over Gray Amalga it is said to withstand the corrosive action of salt atmosphere successfully, whether the metal surface to which it is applied is subjected to heat or remains cold.

El-chem-co thinner is prepared by the El Dorado Chemical Co. for the purpose of thinning Gray Amalga or Hi-Tem-Al in the event that thinning becomes necessary.

All the above products are now on the market and information concerning their use and adaptability will be furnished by the manufacturers.

Editorial

Plans for 1932

IT is not so many months since the question, "How's business?" provoked at best either a disgusted look or a contemptuous sneer. Lately, although the replies are not what the cheery optimist can convert into "boom" propaganda, the question is being answered, and this is a distinct advance. Moreover, some of the replies show a new kind of intelligence, a recognition of the fact, which should have been obvious to everyone for more than a year, that the restoration of "business as usual" will come only through the concerted determination of large numbers of business men and not through the adoption of quack remedies. It is apparently becoming unfashionable to quote glibly the assertions of others, to pass cheap and undependable gossip from mouth to mouth. The reaction to this all-too-common weakness shows itself in a strong and widespread desire to indulge in independent thinking, and this is certainly a contrast to the confusion that has characterized too much of the general discussions and guaranteed nostrums of the would-be economic doctors.

This change of attitude is visible everywhere, although the exceptions are still undoubtedly in the majority even though somewhat less voluble than a few months ago. Men are becoming distrustful of the man who prognosticates a revival on a certain day or as the result of a certain act, and the latter, conscious of the discredit which his foolish utterances are gaining him, is becoming more cautious of his speech and, perhaps for that reason alone, more cautious in his thinking. This is a change of viewpoint which has been badly needed and, now that it has reached noticeable proportions, may be taken as a sign of genuine encouragement. When men begin to think about their troubles, instead of crying about them, the troubles are in a fair way to being remedied.

This year's replies to the thousands of letters written by us to our readers, in order to obtain a better cross-sectional view of nationwide opinion in our industries, disclose a much greater degree of caution than those of previous years. There runs through most of them a wish not to be quoted, due obviously in some cases to the candor of the responses and, in many cases no doubt, to an increasing conservatism, an unwillingness to talk easily on subjects that are still not generally understood and on eventualities that no one can foresee. Almost every one of the replies indicates, either expressly or through implication, a recognition of the seriousness of the subject discussed, of its great impor-

tance to people in every walk of life, and of the danger of loose talking and careless rumor-peddling. At no time in two decades have we seen in any industry such a unanimity of opinion as is now shown by this preponderance of cautious statement and the desire to avoid the extravagance that marks most off-hand opinions.

Inasmuch as only a few of the hundreds who responded to our questions did not request secrecy and inasmuch, too, as *verbatim* reprinting of the replies of those who did not is for the most part impossible without exposing facts that could easily be traced by their writers' competitors, it will be necessary to attempt a general classification of the answers and to draw some reasonably safe conclusions from them. At the outset it may prove interesting to know, as an indication of the extent of the investigation as well as of the interest of those questioned, that 4,288 letters brought 2,747 replies after eliminating duplicates emanating from the same companies. This return, which is the highest, both in number and percentage, of those received from previous similar questionings, indicates the great interest shown in the subjects suggested and, as before stated, the wide recognition of their importance at this time.

The material aspects of the questions and answers—that is, those aspects which deal with the questions touching output and production facilities—reveal some unexpected views and plans. While, as would be expected, there is little tendency toward the erection of new plants—all branches of the non-metallic-mineral industries being adequately equipped to meet probable demands for at least another year—there is a widespread tendency toward plant betterment. Producers planning the building of new plants represent less than 3 per cent. of the number who have given information on this point, while plants which plan some form of production improvement involving new equipment amount to 89.4 per cent. The remainder, about 8 per cent., either do not intend to make any changes or do not know what they will do. Many of this group, which numbered only 183 of the 2,335 who answered the production-facility questions, have doubtless since decided on some form of improvement, and many others will no less certainly do so in the early months of this year. Of the 2,152 concerns who intend to make changes, only 65 will build new plants, while 2,087 will make some form of improvements.

The nature of these improvements indicates very

accurately the intentions that lie back of them. Of the 2,087 plants which had definitely planned some form of improvement at the time the answers were prepared, 262 have decided on some kind of remodeling or rebuilding, in some cases the rebuilding of certain departments, necessitated by fire, a desire to balance production between different departments, a desire to bring about a more uniform operating efficiency, or other causes. In other cases the changes to be made are of much less importance, although falling in the rebuilding class. The remainder include 543 plants planning minor changes, 1,230 planning major improvements, and 152 that neglected to describe the contemplated improvements. In the second class are included such changes as the introduction of slurry filters, new crushing equipment, new screening and washing facilities, closed-circuit grinding, dust-collectors, different quarry transportation systems, and the like. The minor improvements include, for the most part, the substitution of new and better motors, drill rigs, kiln linings, and so on.

Although the price situation among equipment manufacturers has not equalled that among producers, nevertheless it is difficult to estimate very closely the aggregate cost of these various changes. Therefore, our calculation of approximately \$18,380,800 as the probable cost of the improvements indicated by the replies received from 64 per cent. of the companies addressed may be subject to minor adjustment upward or downward. In any case it discloses an enormous aggregate improvement of the production facilities of our industries. If the hundreds of plants from which no replies were received or requested maintain the same average as those who responded, the total cost of new plants and improvements may reach \$28,700,000. Incidentally, other purchases, not included in the questions asked—replacements and supplies—will add much more to the figure last named.

With respect to the outlook for 1932 it is more difficult to classify the answers, for these are involved with so many different facts and so many qualifying statements of conditions and opinions that definiteness is hard to find. The chief characteristic that runs through almost all is a well-reasoned expectation—it would be wrong to call it optimism—founded on known and verifiable facts, that business will be better in 1932 than in 1931. The estimates vary from nothing up to as much as 40 per cent. on the increase side, and run down to 25 per cent. on the decrease side. In almost every case where the percentage is much above the average of all the answers, some local condition—such as special road or building contracts, bond issues, prices, elimination of certain damaging competitive elements, etc.—accounts for the difference. The average increase in tonnage expected by all those who have reason

to count on an upward turn is a little over 23 per cent., while the average decline of those who expect business to be poorer is about 4 per cent. The net average expected change, as shown by a weighted appraisal of all the replies received, is a gain of more than 22 per cent., the number of those who expect their tonnage to be less than in 1931 being very small.

The voluntary remarks offered by most responders disclose the alteration in attitude which was mentioned at the beginning. Some of these are very brief and very pointed; many of them are lengthy and discuss cautiously and with good judgment the reasons for expecting an improvement this year; others, as usual, state their expectations but not their reasons. The last-named type of answer, which in previous years has always formed the majority of the replies, this year is in the minority and, therefore, presents some of the best evidence of the saner thinking which characterizes this year's responses. Men are doing more thinking and less talking, realizing that the country can not be talked out of the doldrums as easily as it can be talked into them, but that relief must come from intelligent thinking, careful planning, and definite action.

In our opinion this is the most encouraging sign of the period. As long as men were content to gossip easily about their troubles and to spread the exaggerated accounts of other people's difficulties, there was small chance of improvement, for this form of mutual commiseration only increased their mistrust and fears and destroyed their faith and *morale*. Now that panic is giving way to reflection, we may expect to see marked gain, first, in confidence and, later, in action. With the restoration of justifiable confidence, based on a knowledge of conditions and of what each one can do toward improving them, will come the actual betterment for which nearly every one has passively waited but for which, until recently, few have made any definite-action plans. The letters of 2,747 nonmetallic-mineral producers, so briefly reviewed here, constitute the industry's answer to the fearful and the slothful, the despondent and the passive. In rising from the lethargy that has held all industrial activity in its grip for more than two years our industries are determined to avoid the follies of the "boom" propagandist as well as those of the gloom spreader. They have done more than their share of deep thinking about the situation that has confronted all business, and they are prepared with definite plans for a wholesome and conservative program, not of expansion but of betterment. This changed attitude will be evident in every phase of our business, the administrative, the technological, and the productive, and business generally will be much the better because of it.

Associations Announce Plans for Annual Conventions at Pittsburgh

Crushed-Stone, Sand-and-Gravel and Ready-Mixed-Concrete Groups Convene This Month

THE National Crushed Stone Assn. has announced its tentative program for the fifteenth annual convention which takes place January 19 to 22 at the Hotel William Penn, Pittsburgh, Pa.

The gathering will open on the morning of Tuesday, January 19, with an address of welcome by Alderman John S. Herron, president of the Pittsburgh city council. F. O. Earnshaw, president of the Pennsylvania Stone Producers Assn., will respond. A. L. Worthen will then deliver the presidential address. Members of the board of directors will report on business conditions in their localities.

The afternoon session on Tuesday will be largely devoted to a discussion of low cost roads. H. P. Chapman, chief engineer, Ohio Highway Department, will be the chief speaker. P. B. Reinhold, chairman of the research and advisory committee, will conclude this session with a presentation of the committee's activities and program. A. T. Goldbeck will lead the discussion following Mr. Reinhold's presentation.

P. J. Freeman, chief engineer, bureau of tests, Allegheny county, Penn., will present a paper on "Effect of Coarse Aggregate on the Durability of Concrete" at the Wednesday morning meeting. R. L. Fox, city engineer, Bethlehem, Penn., will follow with a talk on the use of stone sand in concrete construction. Stabilization of the highway-building program will be discussed by Chas. M. Upham, engineer-director, American Road Builders Assn.

On Wednesday afternoon a group session for salesmen will be held and concurrently with it there probably will be a meeting of the National Agricultural Limestone Association. Mr. Goldbeck will address the sales group on "Do You Know?" He will present information of interest to assist in selling crushed stone. A discussion of "Advantages of a Uniform Sales Contract" is also planned.

On Thursday morning the session will be opened with a paper by F. E. Swineford, chief engineer, Ohio Crushed Stone Assn., on "Pavement Surfaces Suitable for Airport Construction." Dr. Ralph J. Watkins, director, School of Business Administration, University of Pittsburgh, and Harold Williams, attorney, Boston, Mass., will discuss plans for the recovery of business. The association's uniform cost-accounting system will be presented by Wm. E. Hilliard, chairman of that committee and the session will be concluded with the report of the nominating committee. A special luncheon for cost accountants will provide an opportunity for an exchange of ideas regarding operation of the association's approved cost-accounting system.

A group session on Thursday afternoon for su-

perintendents, operating men and manufacturers will be held. The annual banquet will take place Thursday evening.

The subject of ready-mixed concrete will be considered Friday morning. Scott Turner, director, U. S. Bureau of Mines, will present the association safety trophy to the Cape Girardeau quarry of the Marquette Cement Manufacturing Co. and the convention will close with committee reports and the installation of officers for the new year.

THE National Sand & Gravel Assn., also convening at the William Penn Hotel in Pittsburgh, will hold its sessions January 27, 28 and 29. The program, as tentatively outlined by Stanton Walker, will be as follows:

The morning session on January 27 will be opened by an address by R. J. Potts, president. The main speaker at this session will be Willard T. Chevalier, publishing director, *Engineering News-Record*. Mr. Chevalier's address will deal with the general state of affairs in the construction industry, reasons for current difficulties, etc. His address will be followed by a talk entitled, "Sales Lubrication," by E. J. Doyle, president, Doyle Gasoline & Oil Co., Inc., Rochester, N. Y.

The usual luncheon of exhibitors and sand-and-gravel producers will be held, at which the exhibit will be formally opened. This will be presided over by J. L. Shiely, of St. Paul, Minn.

The afternoon session is arranged particularly for superintendents and operating men of the sand-and-gravel industry in conjunction with the members of the Manufacturers' Division. Papers will be presented by sand-and-gravel producers on their operations.

"The Mining and Preparation of Sand and Gravel at the Dallas Washed & Screened Gravel Co. Plant, Dallas, Tex.," will be presented by Ralph S. Windrow.

"Mining Methods and Costs at the Ward Sand & Gravel Co., Oxford, Mich.," is the subject of Fred-eric Ward's paper.

George Williamson will deliver a talk on "Dredging Methods and Costs of J. K. Davison & Bro., Pittsburgh, Pa."

The morning session on January 28 will be devoted entirely to subjects of an engineering nature. F. H. Jackson, senior testing engineer, U. S. Bureau of Public Roads, will present a paper on specifications for concrete based on designing the proportions to furnish a required strength. Stanton Walker will present a discussion of Mr. Jackson's paper, and, since this is such an outstanding ques-

tion at the present time which has a considerable effect on the competitive relationships of different aggregate producers, there will no doubt be much discussion from the floor.

At the same session H. S. Mattimore, engineer of materials, Pennsylvania State Highway Department, Harrisburg, Pa., will deliver an address entitled, "Some Comments on Aggregate Specifications."

P. J. Freeman, chief engineer of tests, Allegheny Department of Public Works, will present a paper on specification and production problems from the viewpoint of the engineer.

J. W. Kelly, formerly district representative of the National Sand & Gravel Assn. in Minnesota, will present a paper on "Some Factors Entering Into the Use of Aggregates from Local Pits for State Highway Paving Construction." Mr. Kelly spent the 1931 construction season in Minnesota for the express purpose of studying this problem.

The afternoon session on January 28 will be in the nature of an "open forum." It is designed to promote a frank discussion of business conditions by producers. This session will be introduced by two prominent speakers. O. W. Irwin, president, Concrete Reinforcing Steel Institute, Youngstown, O., will deliver an address entitled, "How to Get Along with Your Competitors." Ralph J. Watkins, director, Bureau of Business Research, University of Pittsburgh, will present a discussion on the general subject of plans for stabilization of industry with particular reference to the recommendations of Gerald Swope. Dr. Watkins has made a special study of the various plans which have been advanced and is a speaker of experience along these lines.

The usual annual banquet will take place in the evening. Definite arrangements for a speaker have been made.

The morning session on the final day, January 29, as in the case of the preceding day, will be devoted to engineering subjects. Probably the paper of principal interest will be presented by Bernard E. Gray, highway engineer, The Asphalt Institute, entitled, "The Various Combinations of Asphalt and Gravel for Road and Street Paving." An unusually complete discussion of this paper is expected, since it bears on a subject of increasing interest to the sand-and-gravel industry. Many sand-and-gravel producers and engineers have been furnished with copies of Mr. Gray's paper.

Another paper dealing with the subject of bituminous mixtures will be presented by W. J. Emmons, director, Michigan State Highway Laboratory, University of Michigan. The sand-and-gravel producer has little familiarity with the different types of bituminous cements and it is expected that Mr. Emmons' paper will furnish information on this question in such a way as to permit the average producer to understand the meaning of the various terms applied to different types of bitumens.

Chas. B. Stanton, associate professor of civil engineering, Carnegie Institute of Technology, Pittsburgh, Pa., will deliver a paper on the use of gravel

for railroad ballast. Prof. Stanton is particularly fitted to discuss this question, since he has had considerable experience in railroad engineering, and, since, for several years, he has been chairman of the Subcommittee on Gravel Ballast of the American Railway Engineering Assn. Committee on Ballast.

The principal paper at the afternoon session will be delivered by H. W. Heinrich, assistant superintendent, Engineering and Inspection Division, The Travelers' Insurance Co., Hartford, Conn. The title of his paper is, "Practical Safety Methods Applied to the Sand and Gravel Industry."

The remainder of this session will be devoted to reports of committees, the board of directors, election of officers, etc. Of particular interest will be the Report of the Committee on Cost Accounting and the reports of the executive secretary and the director of the Engineering and Research Division.

THE National Ready Mixed Concrete Assn. meets at the William Penn on January 25 and 26. The convention will be opened with an address by J. E. Burke, president. He will review the activities during 1931 and will outline a program for the future.

Following the presidential address, Cloyd M. Chapman of New York, N. Y., will read a paper on "Ready Mixed Concrete from the Viewpoint of the Architect and the Engineer." Mr. Chapman is a consulting engineer of many years' experience. He is vice-president of the American Society for Testing Materials, as well as chairman of the Society's Committee on Concrete and Concrete Aggregates. He is also vice-president of the American Standards Assn. His address bears upon a matter of great importance to the ready-mixed-concrete industry and, in view of his eminence in the engineering world, his comments will be followed with great interest.

"Control Tests of Ready Mixed Concrete" forms the subject of the next paper by Miles N. Clair, who is associated with The Thompson & Lichtner Co. of Boston, Mass., prominent consulting and testing engineers. Ready-mixed concrete is marketed on the basis of the quality of the finished product. It is essential, therefore, that each producer of ready-mixed concrete equip himself with means for the control of quality. For this reason, Mr. Clair's address will be of particular value.

There is no more important problem in the ready-mixed-concrete industry than that of "Purchase Specifications for Ready-Mixed Concrete," which will be discussed by R. B. Young, of Toronto, Ont. Mr. Young is a consulting engineer who has actively identified himself with the ready-mixed-concrete industry in Toronto. He is a vice-president of the National Ready Mixed Concrete Assn., a member of important committees of various engineering societies, and testing engineer of the Ontario Hydro-Electric Power Commission. There is no one better qualified perhaps to handle this subject than Mr. Young. He has given it particular study in his capacity as chairman of the Subcommittee on Ready-Mixed Concrete of Committee C-9

(Continued on page 44)

Maintains Precise Dispatching System to Regulate Concrete Deliveries



General view of the completed plant with some of the agitator trucks. At the left are the concrete plant and office. The timber structure is the aggregate-handling and storage plant with the garages for the trucks in the foreground.

Remote Control of Equipment Is Another Distinct Feature at San Francisco Plant

By W. E. TRAUFFER

THE commercial production of ready-mixed concrete is an industry which has grown rapidly in its few years of existence and in which marked advances in the design and efficiency of plants and in the quality of the product have come. The early development of this industry was confined almost entirely to the larger industrial centers in the eastern states, although some progress also took place on the Pacific Coast. During the past year or two, however, the Pacific Coast has fully awakened to the possibilities of this industry, with the result that dozens of plants have sprung up, not only in the larger cities, but in smaller communities as well.

The district in and around San Francisco has been especially active, until now almost every suburb or neighboring city has its own central-mixing plant or batching plant for loading mixer trucks. Some of the larger plants are models of efficient design and compare favorably with the best plants in the East. The most notable recent addition to the industry is the plant of the Readymix Concrete Co., Ltd., of San Francisco which went into operation last winter. This plant involves many of the most up-to-date features of design and control and uses only the best and most efficient equipment. It has a capacity of 100 cu. yd. per hr.

This new plant, which went into operation on Feb. 11, 1931, is located at 18th and Carolina Sts., less than 2 mi. from the main Market St. business section. This location also gives easy access to the dock and industrial districts; any part of the city can be covered in a 9-mi. round trip. Its location on a switch track of the Western Pacific Ry. insures

good service in the shipping in of aggregates and cement. The track-storage capacity at the plant is for 20 cars with an additional storage for 60 more cars near. All aggregates are shipped in from the new sand-and-gravel plant of the Kaiser Paving Co. at Radum, Cal., about 25 mi. east of San Francisco, which is also a model plant of its kind.

Seven sizes of aggregates are stored, giving the engineer full advantage of low-water-ratio concrete design. Other advantages are exact automatic water control, automatic and independent cement weighing, full compressed-air controls and open charging hoppers for inspectors to see and test the concrete product in the mixing before loading it in the agitator trucks.

The plant consists of two main units—the aggregate plant and the concrete plant. The former was designed by, and is the property of, the Kaiser Paving Co. which furnishes all the aggregates under a long-term contract. This plant has concrete footings and tunnels and timber bins and superstructure. The concrete plant is of concrete-and-steel construction, with the exception of the aggregate bins which are of steel-braced timber. The structural design of this plant was made by L. H. Nishkian, the mechanical design by J. D. Reiser, and the electrical design by L. F. Leury, all engineers of San Francisco.

The aggregate plant consists of a series of conveyors feeding from a track-hopper to a storage bin of 2,000-ton capacity. This is of the laminated-timber type of construction which was popular when the aggregate industry was in its infancy and is still favored by many operators. On the top of

the concrete floor and foundation of this bin 2-in. by 10-in. boards are laid flat and separated by 2-in. spacers. As the sides are built in this manner, other boards are placed vertically at regular intervals along the walls. Steel tie-rods, running through the bin, tie these boards together and take the pressure exerted when the bin is loaded. The bin has eight compartments, each extending completely across the bin, and each having two gates, one for each of the two tunnels. Only one of the tunnels is now in use, the other being held in reserve until more capacity is required.

Although the bin has eight compartments, only seven sizes of aggregate are stored, including two sizes of sand. This leaves the eighth bin for special sizes. It also leaves a reserve storage capacity to prevent demurrage on rock cars should one size of aggregate become overstocked. Because of the close tie-up with the aggregate producer, however, this will probably never be necessary.

A series of conveyors feeds from the aggregate bunker to another timber bin over the mixing plant. This has a capacity of 240 tons and also has eight compartments, each extending the full width of the bin. The bin is composed of wedge-shaped compartments arranged in the form of a fan. The bottoms of the compartments are narrowed to such an extent that each can discharge into the aggregate batcher and their tops flare to give storage capacity.

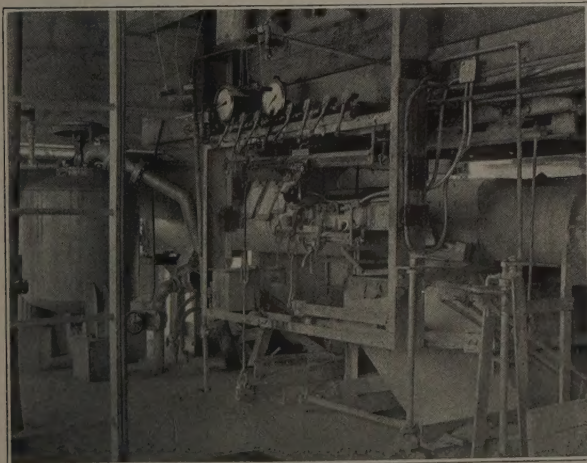
Aggregates are received at the plant in bottom-dump cars which discharge through a 3-in. bar grizzly into a 2-compartment steel-lined concrete track hopper. A belt-feeder under each of these compartments discharges to an inclined belt-conveyor (No. 1). This emerges from the concrete tunnel parallel to the railroad siding and discharges through a steel chute to another inclined conveyor (No. 2), which carries the material to the top of the storage building. This conveyor is parallel to No. 1 and in turn discharges at right angles to a short inclined conveyor (No. 3), which feeds a shuttle conveyor (No. 4) that feeds to any one of the eight compartments in the aggregate-storage.

The two belt feeders are 24 in wide, operate on 15-ft. centers and are speed-reducer- and chain-driven through a drive shaft from the same 7½-hp. Allis-Chalmers motor. Conveyor No. 1 is 24 in. wide, operates on 150-ft. centers, and is driven by a 20-hp. motor through a speed-reducer. Conveyor No. 2 is 24 in. wide, operates on 200-ft. centers and is speed-reducer-driven by a 20-hp. motor. Conveyor No. 3, driven in the same manner by a 10-hp. motor, is 24 in. wide and operates on 40-ft. centers. The shuttle conveyor is reversible, discharging at either end, and is driven by a 7½-hp. Allis-Chalmers motor. It is 24 in. wide and operates on 50-ft. centers. The conveyor idlers are closely-spaced where the material is discharged on the belts.

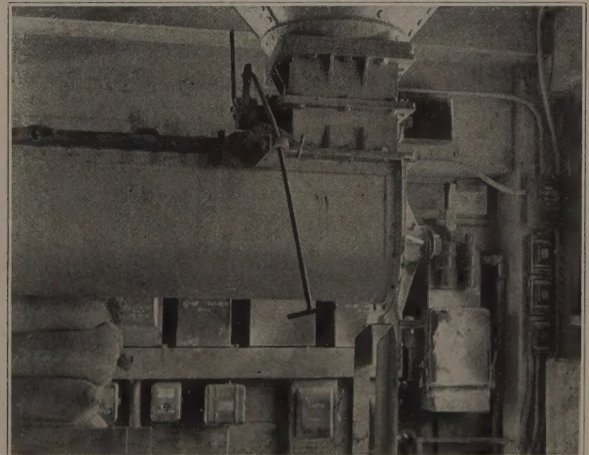
Running longitudinally under the storage bunker is a double concrete tunnel, only one side of which is being used at present. Eight drop chute segmental gates feed from the bins to a tunnel belt-conveyor (No. 5). Each gate is operated by a 1-hp. motor through a worm-gear speed-reducer and rack-and-pinion gears and is protected by a limit switch. These motors are operated by an individual remote-control apparatus which eliminates the necessity for a tunnel operator. Each gate also has its individual local control switch.

The tunnel conveyor is 24 in. wide, operates on 235-ft. centers and is horizontal until it emerges from the tunnel, where it inclines to a point where it discharges through a steel chute to main conveyor (No. 6) to the top of the concrete plant. This conveyor is 24 in. wide, operates on 250-ft. centers, and levels out at its discharge end. This in turn discharges to a second shuttle conveyor (No. 7) which feeds to any of the eight compartments of the 240-ton aggregate-storage bin over the concrete plant.

The tunnel conveyor under the storage building is driven by a 30-hp. motor through a speed-reducer and the main conveyor is driven in the same manner by a 30-hp. motor. The shuttle conveyor to the concrete storage is driven by a 10-hp. motor and is not reversible, discharging at only one end. A flop gate at the discharge end allows the material



View of the batching floor showing the batchers and scales. Levers above batchers operate pneumatic control system. Water-measuring tank at left.



The rotary valve and screw-conveyor which feed cement from storage to the cement-weighing batcher. Electrical-control station for plant in background.

to be shunted to one side or the other, so that the bins can be filled to the greatest possible capacity. The tunnel conveyor is 24 in. wide and operates on 235-ft. centers, the main conveyor is 24 in. wide on 250-ft. centers, and the shuttle conveyor is 24 in. wide on 50-ft. centers.

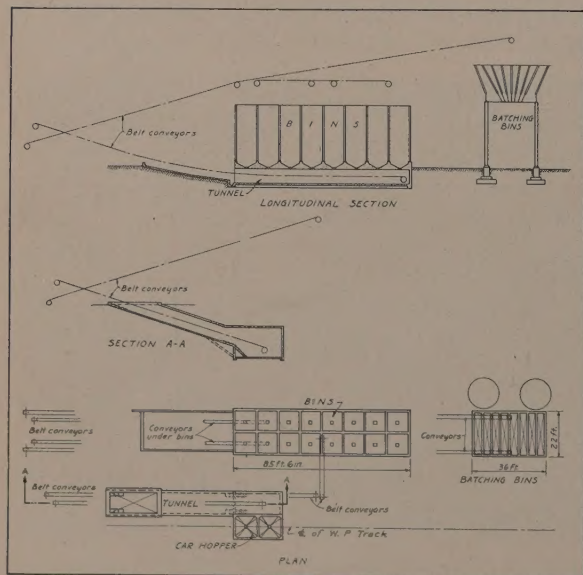
Cement is received in bulk in box cars which are "spotted" alongside a cement-unloading building. Unloading is done with a Fuller Co. Type B portable unloader which has a capacity of 125 bbl. per hr.



Another view of concrete plant with office at right.

This feeds through a 4½-in. rubber hose to a 4-in. line, which discharges to either of two 875-bbl. circular steel storage-tanks above the concrete plant. A third cement bin of 1,000-bbl. capacity is now being installed to give added capacity and flexibility.

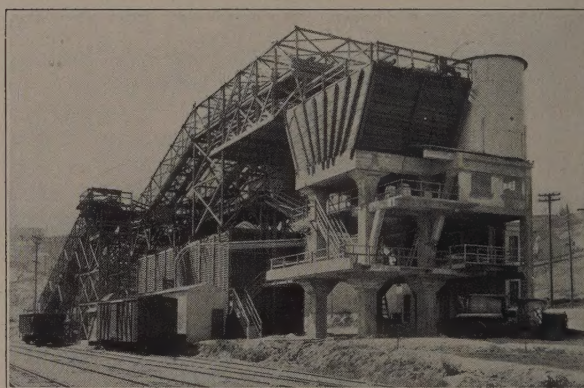
Each cement-storage tank discharges through a Fuller Co. rotary valve to a short 14-in. screw-conveyor. Six air jets in each tank fluff the cement and prevent bridging. Each of the two screw-conveyors discharges to a second 14-in. screw-con-



Plans and elevations showing the plant lay-out.

veyor, both feeding the 2,200-lb. cement-weighing batcher. The feed screws have an automatic motor control which feeds the cement to the batcher within 10 to 20 lb. of the desired weight. The last few pounds are added by means of a jog switch registering on a tell-tale dial. Each of the last two screw-conveyors is driven by a 10-hp. motor through a worm-gear speed-reducer. These reducers drive the first pair of screws through chain and bevel gears.

Aggregates are fed from the eight bins through air-controlled sliding gates operated by means of valves in front of the operator. The fan-shaped bin arrangement allows each of the eight bins to discharge directly into the 20,000-lb. aggregate-weighing batcher which is 18 ft. long. Any desired number of sizes of aggregates can be weighed in this batcher which has a single-beam scale with a tell-tale dial. The average 3-cu. yd. batch requires



Materials-handling side of plant showing cars of cement and aggregates being unloaded. This view clearly illustrates the unusual design of the plant and the fan-shaped aggregate bins over the concrete plant.

from 10,000 to 12,000 lb. of aggregate and consists of two sizes of gravel and one grade of sand. Both the cement- and the aggregate-batchers are equipped with Fairbanks beam scales.

The mixing water used in the plant comes from the city mains. It is measured in a Ransome 125-gal. siphon-type tank, which is calibrated so that any amount of water desired can readily be measured. An air-valve in front of the operator controls the inlet and outlet valves to the tank so that one is closed when the other is open and *vice versa*. Merco-Nordstrom valves are used.

The water, cement and aggregates are discharged through air-controlled gates into the Norris K. Davis 84S drum-type mixer located on the floor below. This discharges to a 2-compartment movable hopper below, which allows fast loading into the trucks and equalizes any delays caused by temporary truck shortages. Each truck driver loads his truck from these hoppers by means of an air-operated gate. The hopper is moved by a 5-hp. motor through a worm-gear speed-reducer controlled by a switch on the operator's platform. A limit switch prevents over travel. The mixer is speed-reducer-driven by a 40-hp. motor.

Concrete is delivered in 12 pneumatic-tired trucks owned by the company. Two of these are

Fageols, 2 are Kleibers, and 8 are Doanes, all made on the Pacific Coast. Each truck has a 2-cu. yd. mixer body, 2 of the bodies being Jaeger, 2 Rex, and 8 Norris K. Davis. At this plant they are used as agitator trucks, so the water tanks have been removed. As agitators they have a capacity of over 3 cu. yd. each. Space has been left in the plant so that a second mixer, with its accompanying batchers, scales and other equipment, can be added at any time.

All the inclined conveyors in this plant have automatic hand brakes to prevent reversing under load in case of power failure and each of the longer conveyors has a gravity belt take-up. All conveyors are driven through Pacific Gear & Tool Works speed-reducers and, with a few exceptions, Sterling ball-bearing motors are used for all drives. Conveyor-beltting was furnished by the American Rubber Manufacturing Co. and the Pioneer Rubber Mills. The conveyors feeding to the main storage-bin also have counter-weighted scrapers with rubber inserts to keep the belts clean.

The entire aggregate plant is controlled from two push-button stations—one controlling all motors delivering aggregates to the main storage-bins, the other controlling the selection of material from these bins and delivery to the bins in the concrete plant. The first station is located over the aggregate plant and the second on the batching floor.



Another view of concrete plant showing charging hoppers under the mixers.

The cement-unloading equipment is locally-controlled and the concrete-plant controls are all located on the batching floor. Westinghouse and Square D switches are used. Crouse-Hinds conduit is employed in both plants, and Crouse-Hinds Ark-tite circuit-breaking plugs are used on the shuttle conveyors. Norris K. Davis, Inc., furnished the concrete mixer, the air-control system and most of the agitator trucks. All the conveyors, automatic and air-controlled bin gates, weighing batchers, cement-storage bins, and the truck-charging hoppers were furnished by the Bodinson Mfg. Co.

The cement-unloading shed also houses two air-compressors. A Gardner-Denver 12-in. by 12-in. compressor furnishes air for the cement unloader, the hopper slide gates, water air ram, mixer dis-



Agitator truck being refueled at the company's own filling station.

charge ram, loading-hopper rams, the air jets in the bins, and for other minor uses. Another compressor of the same make is used as an auxiliary. These compressors are driven by 75-hp. and 40-hp. General Electric motors respectively.

Bulk cement is received in car-loads of 1,300 sacks to the car, each car being bulk-headed in a manner specified by the company. Two partitions are inserted in the car at the cement plant before loading in the form of an X with the end of each partition ending at the side of the car 2 ft. from one of the doors and crossing at the center of the car. In this manner the doorways are kept entirely clear so that they can be readily opened. In unloading half of one partition is removed first, giving access to one end of the car. To unload the other end of the car the corresponding half of the partition is removed on that side. The 2-ft. allowance on each side of the doors prevents spillage of



One of the trucks being washed after completion of the day's work.

the cement when the partition is removed. This arrangement also makes it immaterial which side of the car is toward the unloading platform as it can be unloaded with equal facility from either side.

The office building alongside the concrete plant has well-furnished general and private offices on the second floor. The first floor has an employees' wash- and locker-room with showers, hot water, etc. The dispatcher's room and the testing laboratory

are also located on the first floor. The latter is unusually neat and well-equipped. Among other items of equipment it contains a compression-testing machine, sieves, mechanical sieve-shakers, scales, and all other necessary equipment. This laboratory is used by the plant inspector and is also at the service of any visiting inspectors, whether they are in the service of city, county, state, or private individuals or firms.

All the concrete produced is designed at the plant, mostly on a strength basis, using the water-cement ratio, the company having educated most of its customers to the advantages of strength design. Slump tests are made regularly, and cylinders are made of every run. Accurate check is also kept of the water content of the aggregate used. Cylinders are broken at 7 and 28 days by a Watson-Stillman 200,000-lb. compression-tester.

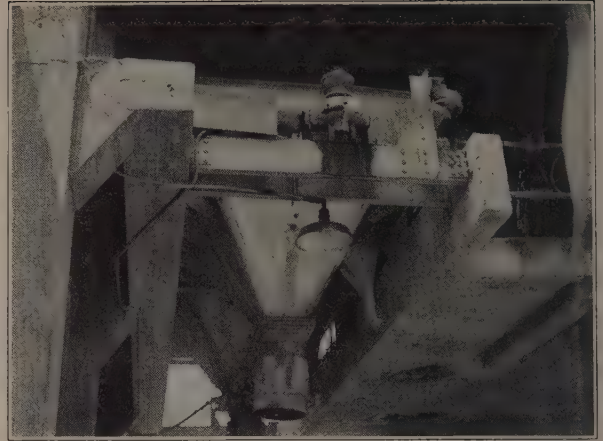
The variety of sizes of aggregates stored allows absolute control of the grading of aggregates to obtain the best possible workability, a low percentage of voids, and the lowest practical water-cement ratio for any given strength. The product is used for all types of concrete construction, there being no restrictions of any kind against its use. It is used for general and public building construction, street paving, concrete piling, piers and many other purposes. Any type of cement specified is used and any admixture, such as Celite, silver-crystalline talc, Tricosal, etc., is added where specified.

It is only natural to expect that a company which would go to such care and expense in building a plant and which exercises such careful quality and strength control would also have a model delivery system. The following description for which we are indebted to W. A. Grant, general superintendent, discusses this system as well as the duties of the plant personnel.

"The plant organization is composed of the following branches: The engineer, who is also superintendent of all operations, has under his supervision the plant-mixer operator, the dispatcher, the cement unloader, the plant and truck mechanic, the truck wash-rack man, the statistical recorder, and the accountant.

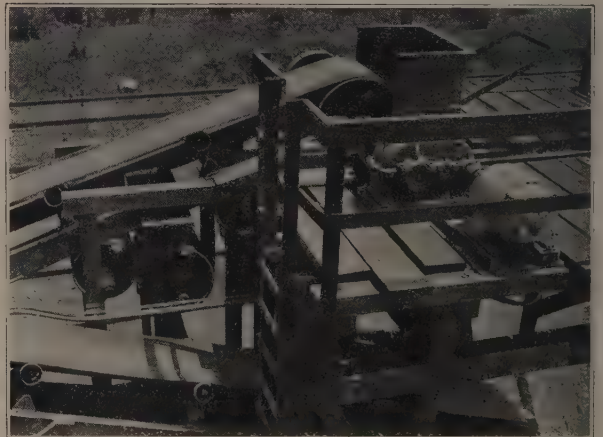


Aggregate-reclaiming conveyor under the main storage bins. Tunnel for future duplicate installation at right. Note the remote-controlled bin gates.



The double-charging hopper under which trucks are loaded.

"Each day the dispatcher receives his orders for the number of cubic yards of concrete to be delivered in the day, the number of trucks to be used, and the concrete mixes to be sent out. The operator receives the weights for each mixture, and the designated number corresponding to each concrete mix. The dispatcher orders what mixes he wants over a special telephone connecting the dispatcher with the operator. The truck driver is ordered out, receives a 3-cu.yd. load of concrete from the charging hopper and his written tag, with the date and time stamped on it by an electric-clock recorder, designating where he is to go. The loading of the 3-cu. yd. of concrete averages $1\frac{1}{2}$ min. Upon his return from delivering his load, the signed tag is restamped with the date and time. From these two time-stamps the trip time is calculated. This is continued throughout the day. Note that each driver receives a load of concrete, then



View showing drive of conveyor from track hopper. Conveyor to aggregate plant at left.

his tag telling where his concrete load is to be delivered.

"At the end of the day all tags are grouped for each job and the bills are made out. These tags then go to the statistical recorder, who figures the average trip time to a certain job for that day. After running a job for three or four times the



The portable pneumatic pump unloading bulk cement from box car.

statistical recorder knows with accuracy what the job time should be. From these facts the excessive time averages are calculated for job delays and the contractor pays the stipulated delay charge for over 5 min. at the job.

"Along with these figures a route diagram is made to show the travel of the truck from the plant to the job. These diagrams are filed away by number, the same number appearing on the city map for reference. In estimating future work the manager and superintendent use these references for calculating the cost of delivery to any point in the city of San Francisco.

"Note also that these route diagrams, with the average delivery time attached, assist the superintendent materially in estimating the number of



Concrete mixer showing discharge to loading hopper.

trucks needed for delivery each day. Another advantage is that the dispatcher, having stamped the time on each delivery tag, can easily refer back to deliveries made weeks before and give the exact date and time at which each load of concrete was delivered to a designated job.

"The cement unloader handles cement most of

the time and, when not doing so, assists in making plant and truck repairs. The wash-rack man has regular hours, his work time of 8 hr. beginning at 11:30 a. m. As trucks come in at noon, his first work is to fill all running trucks with gasoline and oil, while the drivers eat lunch. The balance of the day he works at the wash-rack pit and makes plant repairs. After 5:00 p. m., as all trucks finish for the day, he washes all the vehicles and furnishes them with gasoline and oil for the next day's run. This man is also trained as a plant operator and, in case of 24-hr. runs, is used as a relief operator.



Some of the company trucks pouring foundations for war memorial building in San Francisco.

"The plant and truck mechanic is required to report the mileage of each truck each day to the superintendent, and every 750 to 1,000 mi. each truck is completely greased and has its oil changed.

"Drivers of trucks are rated as follows: At the end of each month the recorded figures—including the cost of running each truck, the best average time made in delivering concrete to jobs, the number of accidents if any, by each driver, the amount of repairs on each driver's truck, the delays, troubles, care of truck and loss of concrete in loading—are compiled. A weighted average is made by the superintendent and a percentage given to each driver. These drivers are rated No. 1, 2, 3, 4, 5, 6, 7, etc. Driver No. 1 receives a cash bonus from the company.

"The order in which drivers are called upon for the day's work in the following month is decided by their ratings. No. 1 driver goes to work first, No. 2 second, No. 3 third, etc., so that it is readily seen that each driver exerts his utmost effort to reach the highest rating, because the following month he is sure of first calls and the highest possible income.

"The statistical recorder spends about 1½ hr. a day to formulate the records and the balance of time in making collections, and in caring for the company's affairs. The accountant takes care of all telephone calls, the books, and correspondence.

"The company also employs a job-service man whose duties include the sale of concrete."

Operators of concrete plants and aggregate pro-

ducers who deliver in their own trucks should find Mr. Grant's delivery system of great interest. The method of figuring delivery costs to various parts of the city through route diagrams of previous deliveries is undoubtedly much more accurate and



Left to right: M. T. Scott, sales manager; W. A. Grant, general superintendent; E. H. Peterson, president; and F. A. Nugent, general manager.

fair to the consumer than the usual method of using maps showing the air-line distances or that of dividing the city into zones.

The delay charge imposed when trucks are held at the job for a period of more than 5 min. may at first glance appear a little too strict. In practice, however, it encourages the contractor to unload the truck the moment it arrives on the job, instead of having two or three loaded trucks standing about the plant awaiting his convenience, as is often the case when no penalties are imposed. The concrete producer gains in having his trucks always on hand on schedule time, thus getting the greatest possible capacity out of each truck. In talking to some of the contractors the writer learned that they are in favor of this system, as most of them get the trucks away consistently in less than 5 min. time, thus getting a rebate from the cost of the concrete instead of incurring a penalty.

The company has had considerable experience in the concrete-producing industry, having operated another plant a short distance from the present location for over three years. This plant was an experimental one and was abandoned when the new plant went into operation. A 2-cu. yd. mixer was used at the old plant and deliveries were made in bath-tub type bodies.

The officers of the Readymix Concrete Co., Ltd., are: E. H. Peterson, president; H. E. Rahlmann, secretary and treasurer; F. A. Nugent, general manager; and W. A. Grant, general superintendent.

Convention Plans Announced

(Continued from page 37)

of the American Society for Testing Materials, and his address at the Pittsburgh convention will unquestionably stimulate needed discussion.

The ready-mixed-concrete operator must acquaint

himself with "Standard Methods for Testing Concrete," for these are functions which involve the very rudiments of his business. The subject will be in competent hands at the Pittsburgh convention, for it will be discussed by A. T. Goldbeck, director of the Bureau of Engineering, National Crushed Stone Assn. The need has been felt for some time of collecting all of the authoritative information on standard methods of testing, for ready reference by the ready-mixed-concrete operator.

At this same session reports will be received from the executive secretary and the director of engineering.

The second annual banquet will be held in the evening.

The second day of the convention will be devoted to an "open forum" and to inspection trips. The forum will begin in the morning and continue as long as interest is sustained. If any time remains, it will be spent in inspecting points of interest in the city, with particular reference to ready-mixed-concrete operations.

Method of Calculating Depreciation on Commercial Vehicles

A rule for calculating the annual depreciation of motor trucks has been developed by H. B. Shaw, director of the Engineering Experiment Station of North Carolina State College. The method follows:

Year by year, calculate the amount of annual depreciation, as 40 per cent. of the value at the beginning of the year, and subtract this amount to get the value at the beginning of the succeeding year. As an illustration: consider a machine which cost, new, \$1,000, and calculate as shown in the first two columns of the following table. The third column of the table shows for comparison the average amounts of depreciation derived from studies of used-machine appraisals:

Year of Service	Value at Beginning of the Year	Amount of Depreciation During the Year	Average Amount of Depreciation from Data on Used Machines
1	\$1,000.00	\$ 400.00	\$ 440.00
2	600.00	240.00	220.00
3	360.00	144.00	120.00
4	216.00	86.40	80.00
5	129.60	51.84	40.00
6	77.76	31.10	50.00
7	46.66	18.66	20.00
		\$ 972.00	\$ 970.00
(Junk value)		28.00	30.00
		For check, total \$1,000.00	\$1,000.00

This rule of constant depreciation of 40 per cent. on the depreciated value at the beginning of the year closely approximates the results of detailed studies of voluminous data on appraised values and junk values of used machines, as will be seen.

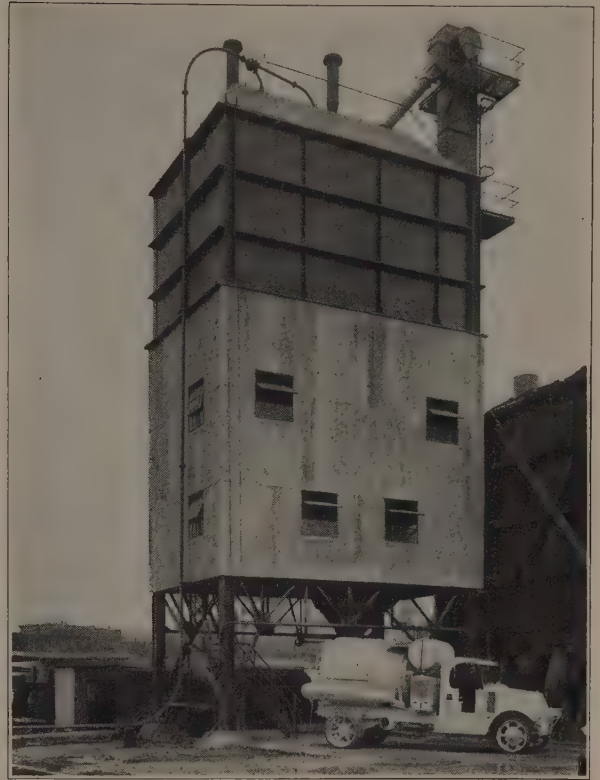
New Batching Plant in Brooklyn Uses Automatic Control

Photoelectric Cells Assure Accurate Measurement of All Materials

PROGRESS in the ready-mixed-concrete industry has been so rapid during the past few years that no sooner is a new plant completed and acclaimed as the most modern in existence than another is under construction which will take its place at the head of the list. It is hard to see, however, how any other plant of its type can soon replace the new central-batching plant of the Cranford Material Corp., in Brooklyn, N. Y. In its design this plant leaves nothing to be desired and its control system is as nearly automatic as it is possible to conceive.

This system centers about the use of a photoelectric cell, or "electric eye" as it is more commonly known. So far as is known this is the first plant to use a photoelectric cell built into dial scales to insure the accurate measurement of the various ingredients, which is so necessary to the production of concrete of unvarying quality. This plant almost eliminates any possibility of human error and requires the use of only one man to do all the batching. The water-front location of the plant is an advantage, as all material is received by barge, eliminating delays due to congestion at the metropolitan railway terminals. Other features of the plant are its unusually large extra-storage facilities of about 5,000 cu.yd. and the flexibility of this storage system.

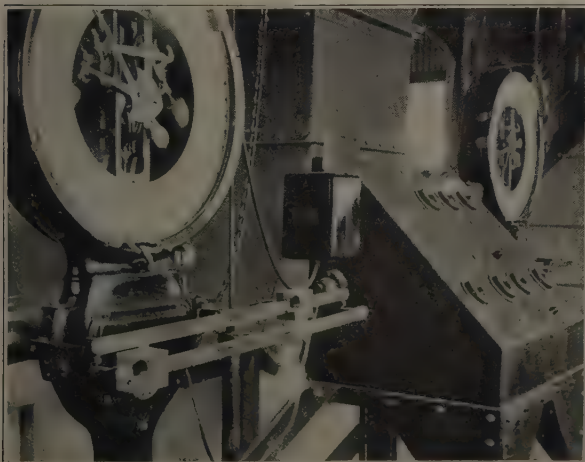
The plant is located at the company's building-supply yard on the Gowanus Canal between Ninth and Eleventh Sts. in Brooklyn. This canal is a feeder from Upper New York Bay serving the



The batching plant with gravel bins and elevator at right. Barge on canal being unloaded in background.

many industries located in this district. Sand and gravel, crushed stone and cement are received at the yard in barges. The aggregates are purchased from local producers and are unloaded by a stiff-leg derrick with a 2-cu.yd. Owens clam-shell bucket, either to a belt-conveyor which carries them to the yard storage unit, or to a receiving hopper for the concrete plant. Both systems will be described later.

Cement is received in bulk by barge from any of a number of railway terminals in the metropolitan district. On one side of the canal alongside the plant a slip just long enough for a barge allows



Dial scales with photoelectric-cell controls and the master control panel which controls all operations in the plant.



Another view of the batching floor with dial scales and operator at control panel. Aggregate batcher, left; cement batcher, right.



Looking into batching hopper showing bottoms of weighing batchers and remote-control dump gates.

the unloading of the cement without obstructing traffic on the canal. Cement is unloaded by means of a Fuller-Kinyon 6-in. portable unloader, connected by a flexible rubber hose which leads to a permanent shore-line that feeds the cement bins in the mixing plant. The power line for this unloader is connected to a Crouse-Hinds circuit-breaking plug-receptacle on shore. This type of cement-handling equipment is especially suited to this operation because of a tidal variation in the level of the canal which made any other method impractical. A 1,300-bbl. barge is unloaded in about 12 hr.

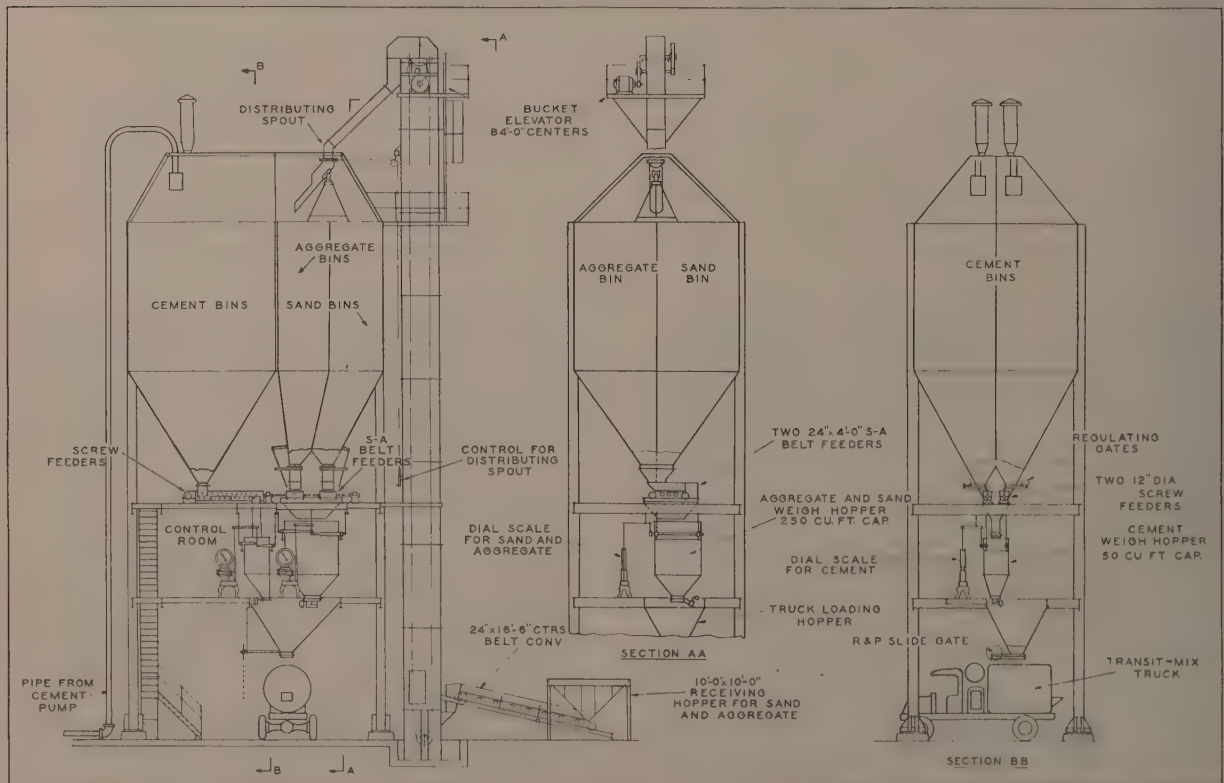
The concrete plant is of entirely fireproof construction, with concrete driveways and foundations and steel framework, floors and bins. It is entirely inclosed with corrugated-metal siding. Cement is

stored in a two-compartment steel bin with a total capacity of 2,200 bbl. and this allows the storage of two different kinds of cement if desired. Aggregates are stored in a four-compartment bin with a total capacity of 250-cu.yd., greater storage capacity being unnecessary because of the other storage facilities located near. These facilities will be de-



Screw-conveyors feeding cement from bins.

scribed in more detail later. An automatic signaling system in each of these bins warns the plant operator when it is almost full. This system consists of a swinging paddle, which is pushed aside by the material as it nears the top of the bin and sounds a warning horn in the control room.



Cross section and elevation of plant with additional views showing arrangement of aggregate and cement-handling facilities.



Feeder floor showing method of feeding aggregates from bins.

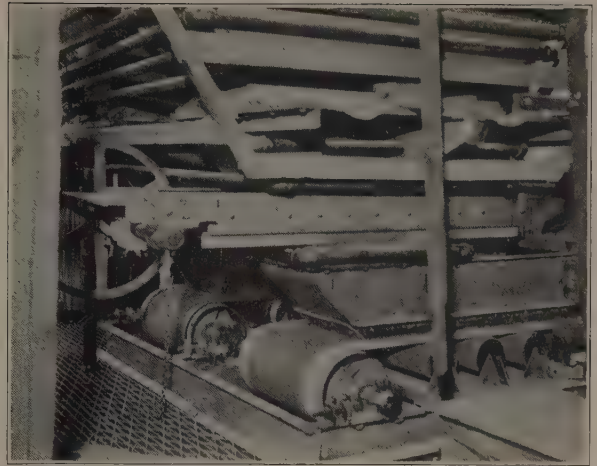
Cement is drawn from storage by either of two 12-in. special triple-threaded screw-conveyors. Discharge of the bins to the screws is controlled by sliding gates, and air jets prevent bridging of the cement in the bins. Both screws are driven by the same 3-hp. Westinghouse motor through a DeLaval worm-gear speed-reducer, a clutch allowing either conveyor to be used as desired. The construction of the conveyors practically eliminates flooding and insures a steady feed. A General Electric magnetic brake on the motor drive-shaft allows accurate control of the feed to the weighing equipment. Sand and stone are fed from storage by two 24-in. belt-feeders, each of which is driven by a 3-hp. General Electric motor through a De Laval worm-gear speed-reducer.

A 10-ton capacity weigh-hopper is used for the aggregates and one of 2½ tons capacity for the cement. Each of the hoppers has a special Toledo



Close view of one of cement-feeder drives.

dial-scale fitted with photoelectric-cell control, which automatically stops the feeders when the exact desired weight is reached. A glance at these scales tells the operator the exact amount weighed for each batch, so that in case under- or over-weights should occur these could immediately be eliminated



Aggregate bins inclosed with steam pipes for winter operation.

by adjustment of the control mechanism. This system is so designed that an automatic recorder can be installed at any time to record the weights of the various ingredients in each batch produced.

The weigh-hoppers discharge to a batch-hopper below which has a canvas cover to confine the dust. A rack-and-pinion slide gate, operated by the truck driver, discharges the materials to the truck. Water for each mix is measured in a calibrated tank from which it is discharged to the truck tank.

As previously stated, practically every operation is controlled from the batching floor of the plant. A control panel, conveniently situated between the two scales, has a push-button for each conveyor, feeder and gate and a pilot-light for each unit to show the operator whether or not it is functioning properly. As long as the lights remain red the units are in operation. All controls are interlocked to prevent the flooding of any unit. A telephone connecting with the plant office is used for transmitting orders.

The scales used were specially designed for batching work and are provided with adjustments to compensate for any conditions that may arise. The aggregate scale has an adjustment for the moisture content. Both scales absolutely eliminate the hu-



The rotary compressor which furnishes air for cement unloading.



Unloading bulk cement from barge with a portable pneumatic pump.

man error in weighing by the use of a photoelectric cell. In actual operation the cement scale-dial is set for the desired weight and the feeder is started. The aggregate scale is then set and its feeders are started. On each scale, as the desired weight is reached, the pointer of the scale shuts off the light from the photoelectric cell. This, in turn, trips a relay, which stops the feeder motor, and it also applies the magnetic brake on the motor shaft, preventing overfeeding due to the momentum of the motor and to shutting off the feed instantly. To the casual observer it might seem that a certain slight variation in weight might occur due to the amount of material in the air between the feeder and the hopper at the time the feeder is shut off. The quantity of this material is constant because of the uniformity of the feed and has been compensated for in the scale adjustment with such accuracy that only insignificant variations are possible. The pointers on the scales allow an instant check on the accuracy of the control system at any time.

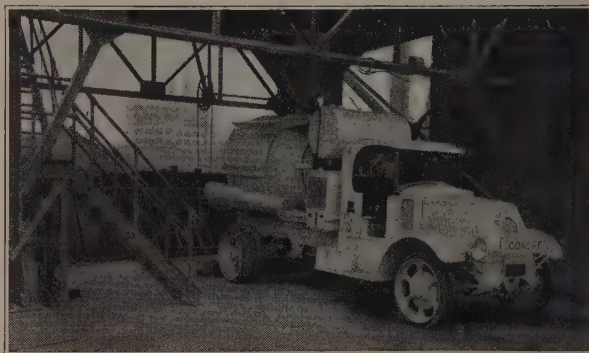
The concrete is mixed and delivered in $4\frac{1}{2}$ -cu.yd. mixers mounted on 6-cyl. Mack solid-tired truck chassis. At present three Jaeger and three Chain-Belt Rex units are used, all actually hauling and mixing their full rating. During rush seasons ad-



One of the company's trucks delivering concrete for subway construction.

ditional trucks are hired. Practically the entire output of the plant is sold in the Brooklyn area for subway and paving work. All the concrete mixtures used are designed by a well-known testing laboratory and concrete is sold on a strength or volume basis.

The aggregates, as previously stated, are unloaded from the barges by a stiff-leg derrick fitted with a clam-shell bucket. This handles the material directly into any of five storage bins of 600-cu.yd. capacity each. These are used for truck loading, and four of them are also equipped to deliver material to the concrete plant. Short 24-in. inclined belt-conveyors feed from gates under these bins to a 24-in. horizontal belt-conveyor which discharges to a steel-enclosed bucket-elevator at the concrete plant. This elevator operates on 84-ft. centers and has a capacity of 100 cu.yd. per hr. A movable spout allows discharge into any of the four bin compartments over the plant and is controlled from the batching floor by a wheel and cable.



Loading one of the $4\frac{1}{2}$ -cu. yd. mixer trucks.

The derrick can also unload from the barges to a hopper feeding directly to the conveyor which leads to the plant when desired.

Two of the five yard storage bins, one containing sand and the other stone, are sheathed inside and have steam coils which prevent freezing and insure a supply of aggregates for the concrete plant in even the coldest weather. The fifth bin is used for gravel storage and truck loading only, as no gravel is being used at present in the concrete plant. The derrick can also feed to a Hunt gravity-car distributing system which feeds to a 9-bin secondary storage of 2,000-cu.yd. total capacity. This has a reclaiming conveyor which can also feed to the conveyor leading to the plant. The Hunt system also feeds to a 200-cu.yd. bin, separate from the other storage units, which is used for dry-batching to trucks. This unit can also be used for concrete batching using sacked cement should the necessity arise and has a capacity of 200 cu.yd. per hr.

Steam coils have also been installed around the aggregate bins in the concrete plant and provisions made to heat the water used. A 3,500-gal. water tank near the plant is equipped with steam coils to heat the water to any temperature desired. A Minneapolis Honeywell automatic control allows the water to be heated to the desired temperature and then shuts off the steam. When the water tempera-

(Continued on page 89)

Cement-Producing Capacity Increased in 1931 Due to Improvements

No New Plants Built in United States During Year While Mexico Erected Two

THE Portland-cement industry in this country during 1931 followed the same trend as in the previous year. As in 1930, no new plants were built in 1931 but the capacity of the industry, judging from all indications, was increased to an even greater extent than in the previous year. Government figures show that in 1929 the industry's capacity was 259,000,000 bbl. and at the end of 1930 about 270,000,000 bbl., an increase of 11,000,000 bbl. in spite of the fact that no new plants were built. Production, however, showed a considerable decrease below that of the previous year, both in its relation to production capacity and in the actual quantity of cement produced.

Cement producers are showing an increasing tendency toward the improvement of existing plants wherever possible. Improvements made during 1931 include the installation of longer kilns, closed-circuit grinding systems, slurry-filters, dust-collectors, and other equipment designed to decrease operating costs and increase the quality of the cement produced. Any increases in the capacities of these plants due to these improvements were in most cases incidental to the other results achieved. This readiness on the part of producers to expend large sums to improve their plants indicates their attitude toward the future of the cement industry. The most important of these developments are discussed in this review.

The only new Portland-cement plants to be put in operation during the year on this continent were in Mexico and Canada and do not affect in any way the conditions in the cement industry of this country. It is well known that most of the Portland-cement imported into the United States comes from

Europe and that most of that exported goes to Cuba and other territorial possessions. The three new plants mentioned above are those of "La Tolteca" Compania de Cemento Portland, Tolteca, Mexico; Cemento Portland Nacional, Hermosillo, Mexico; and the Canada Cement Co., Montreal, Que., Canada. Complete progress stories of the two Mexican plants were published in PIT AND QUARRY during the past year. The Montreal plant is not entirely a new operation as it replaced an older plant on the same site but this was enlarged and improved to such an extent that it is practically an entirely new operation. A discussion of these three new plants is given in another part of this review.

"La Tolteca" Compania

The larger of the two plants built in Mexico in 1931 is that of "La Tolteca" Compania de Cemento Portland, Mexico City, D. F., Mexico. It is a dry-process plant with a capacity of 1,200 bbl. per day located within the limits of the city. Most of its capacity is shipped by truck for local use.

The plant is a modern unit, which compares favorably, except in the matter of size, with any of the newer plants in this country. Reinforced-concrete construction was used wherever possible, resulting in a permanent and very attractive plant. There are many mechanical features of interest. An unusual arrangement is the location of the raw-material driers between the feed end of the kiln and the electrical-precipitation system, which is connected to the concrete kiln-sack. This system utilizes the waste heat from the kiln for drying the limestone and clay raw materials.

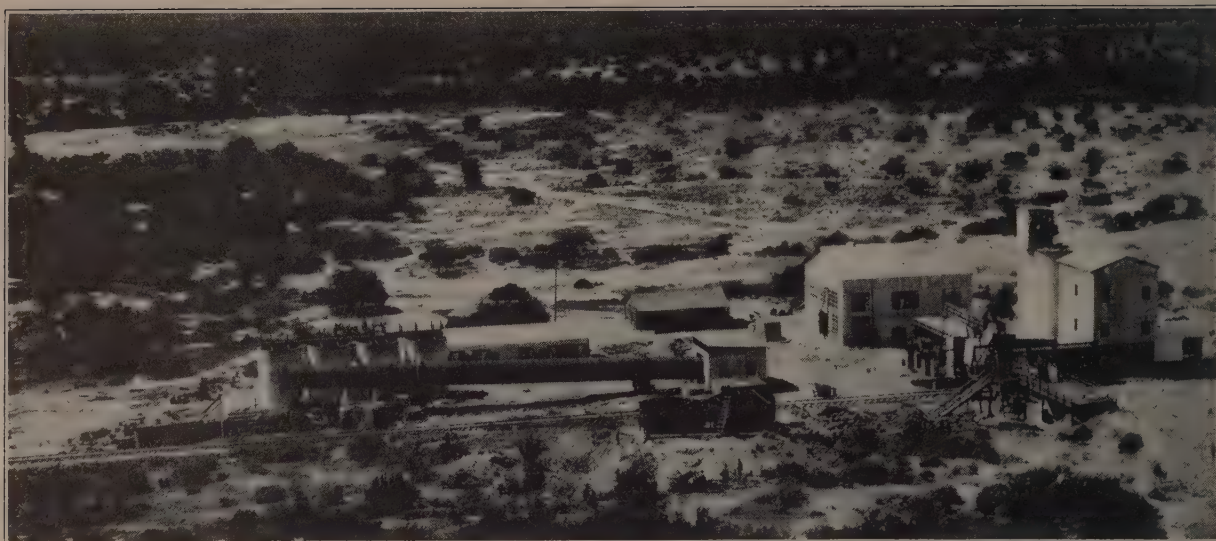
Limestone is reduced to the desired size by a hammer-mill and discharged to a bin or to open



The plant of the "La Tolteca" Compania de Cemento Portland shown while still under construction.



View of "La Tolteca" plant showing kiln, driers, and precipitator building.



Recently-completed wet-process cement plant of Cemento Portland Nacional, S. A., Hermosillo, Sonora, Mexico.

storage in which it is rehandled by an overhead crane. Clay and limestone are fed to two 7-ft. by 70-ft. rotary driers and rehandled back to storage. Raw grinding is done by an 8-ft. by 7-ft. by 32-ft. compartment mill. A pneumatic conveying system carries the product to four blending silos.

The oil-fired kiln was specially designed for maximum efficiency. It is 285 ft. long with a burning zone tapering from 7 ft. to 10 ft. and back to 8 ft. in the preheating zone. Clinker is discharged to an 8-ft. by 90-ft. cooler, which feeds back to the storage building. The finish-grinding mill is similar to the raw-grinding unit. A pneumatic conveying system feeds the finished cement to concrete stor-

the west coast of Mexico. The plant has ample capacity to fill the present needs of the territory it serves but is designed so that its capacity can be increased at any time without hindering production.



Steel bins and concrete silos alongside mill at Hermosillo plant.

age-silos. The pack-house is of the usual type with a dust-collecting system to make conditions pleasant for the pack-house employees.

Cemento Portland Nacional

The other new plant built in Mexico during 1931 is that of the Cemento Portland Nacional, S. A., Hermosillo, Sonora, Mexico. A wet-process unit with a capacity of 500 bbl. per day, it is of especial interest because it was built to supply cement for extensive construction projects contemplated along



Feed end of new electrical-precipitation unit of Universal Atlas Cement Co.

The plant is conventional in design. The stone is reduced to size by primary and secondary gyratory crushers. Raw grinding is done by a 6-ft. by 22-ft. 2-compartment mill. Centrifugal pumps convey the slurry to and from four concrete slurry-tanks, which are provided with mechanical and air agitation. The kiln is an 8-ft. by 150-ft. unit, and finish grinding is done by a mill similar to the raw-grinding unit. Cement is stored in concrete silos and packed in the usual manner.

Provision is made so that stone can be loaded from either of the two crushers to railroad cars. Stone intended for cement manufacture can go either to the raw-mill feed-bin or to open storage, from which it is later rehandled. Clinker from the kiln is discharged to a section of the same storage,

where it can be distributed or fed to the finish-mill feed-bin by a crawler crane equipped with a clam-shell bucket. This unit also handles the gypsum. Power for the entire plant is generated by three 360-hp. Diesel engines direct-connected to generators. Electric motors are used throughout.

Glens Falls Portland Cement Co.

One of the important kiln installations of the year was made at the plant of the Glens Falls Portland Cement Co., Glens Falls, N. Y. This plant, now one of the oldest still in operation, has been kept up to the best standards in the cement industry by a series of improvements and enlargements and compares favorably to any newer plant in efficiency and economy of operation and in quality of product.



One of the feeders under the cement-storage silos.

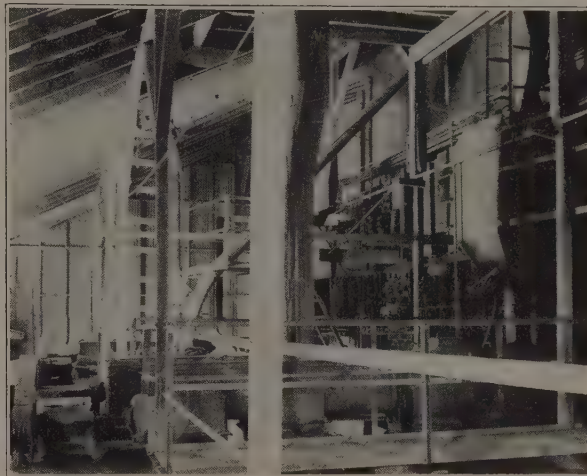
The new kiln installed in this plant early in the year is not the largest in existence but has refinements of design which make it one of the most efficient units in existence. This efficiency is due not only to the design of the kiln proper but also to the methods of control used, some of which are new to the cement industry. A complete description of this plant and its recent improvements is published elsewhere in this issue.



Operating floor of Universal Atlas precipitator unit.

Universal Atlas Cement Co.

The outstanding dust-collector installation of the year, or for that matter, in the history of the cement industry, is that made by the Universal Atlas Cement Co. at its plant No. 6 at Buffington, Ind. A complete description of this installation



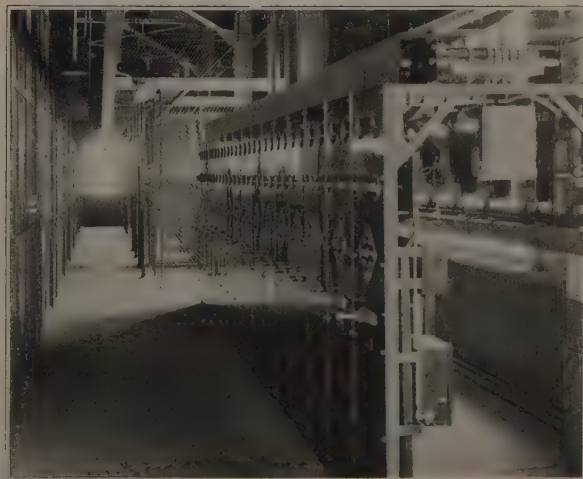
Control board of raw-blending system at Dewey, Okla., cement plant.

was published in the Nov. 4, 1931, issue of PIT AND QUARRY.

This installation is also of interest because it is installed in the largest-capacity single cement plant in the world. Plant No. 6 is a dry-process operation with 14 kilns and has a capacity of 16,000 bbl. of cement per day. The dust-collector is of the electrical-precipitation type and has a capacity of 1,050,000 cu. ft. of gas per min. It serves the raw-material-grinding, coal-grinding and kiln buildings, taking the dust and gases from 15 raw-material driers, 5 coal driers, 14 kilns and all the grinding, elevating and conveying machinery in these departments. A new raw-blending system and waste-heat boilers were also installed at this plant.

Dewey Portland Cement Co.

Early in the year the Dewey Portland Cement Co.



Switchboard controlling precipitators in Universal Atlas plant.



A general view of the dry-process plant of the Dewey Portland Cement Co. at Dewey, Okla.

completed an extensive program of improvements in its dry-process cement plant at Dewey, Okla. These consisted mainly of the installation of closed-circuit raw- and finish-grinding systems and a raw-blending system. This program followed an even more important program of closed-circuit raw- and

Okla., plant has resulted in a raw mix of dry pulverized materials equal in uniformity to the mix in the best wet-process plants. Previous to these improvements one of the kilns in the plant had been lengthened and its burning zone enlarged, resulting in greater capacity and decreased fuel consumption. All these changes contributed to the production of a higher quality of cement at lower operating cost.

Columbia Cement Co.

The second closed-circuit raw-grinding system in a wet-process cement plant in this country was put in operation late in the year in the plant of the Columbia Cement Co. at Zanesville, O. This is similar in many ways to the pioneer installation made by the Dewey Portland Cement Co. at Davenport, Ia., in 1930.

Aetna Portland Cement Co.

One of the several slurry-filter installations made during the year was that at the Aetna Portland Cement Co., Bay City, Mich. This installation culminated an extensive improvement program, which included a closed-circuit wet-grinding system using vibrating screens to separate the mill product. Other improvements were the installation of an air-



Slurry filters at the Aetna plant.

finish-grinding made in the company's wet-process plant at Davenport, Ia., during the preceding year.

The raw-material blending system at the Dewey,



General view of plant of Aetna Portland Cement Co. at Bay City, Mich., with new cement-storage silos in foreground.

cooling system supplementing the rotary clinker coolers, and an additional concrete-silo cement-storage unit. This program resulted in increased capacity, higher quality of cement, and lower operating costs.

Canada Cement Co.

The new plant of the Canada Cement Co. at Montreal, Que., Canada, is a wet-process operation with 13 kilns and a capacity of 3,500,000 bbl. annually. It is now one of the largest Portland-cement plants in existence and probably the largest wet-process unit. This plant replaced a smaller dry-process plant.



Operating floor of electrical-precipitation unit at North American plant.

The Port Colborne, Ont., plant of the same company was also converted to the wet-process during the year and its capacity considerably increased. This plant now operates one of the largest cement kilns in existence. These two plant improvements

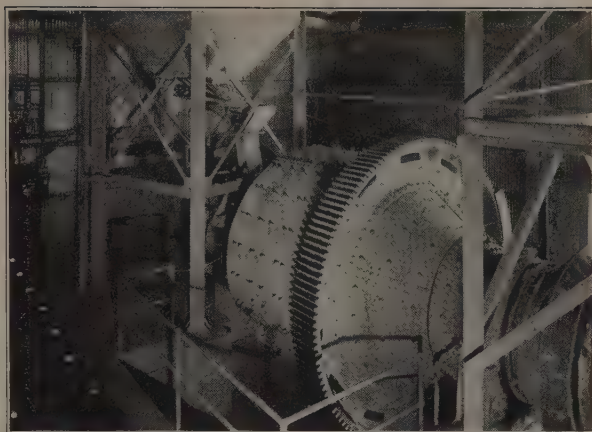


Part of plant of North American Cement Corp. with new precipitator building at left of stack.

closely followed the conversion to the wet-process of the company's plant at Hull, Que., which was one of the major developments of 1930.

North American Cement Co.

The North American Cement Corp., Security, Md., early in 1931 completed another important unit in an improvement program which has been going on since 1928 and which is expected to be continued during 1932. This program began with the instal-



Conical mill and air-separation installation at North American plant.

lation of waste-heat boilers and turbo-generators in 1928, making this plant independent of outside sources of power. A new kiln-stack was erected and other minor improvements were made. In 1929 the finish-grinding department was improved and a new grinding mill installed to allow the production of a more finely ground cement. In 1930 improvements were made in the raw-grinding department, including the installation of a new mill using a reversed-flow air-classification system.

The unit completed in 1931 is a dust-collecting system of the electrical-precipitator type designed primarily to recover dust from the kiln gases. Flue connections to the raw-material driers, elevators, conveyors, and grinding mills also keep these departments free from dust.

Ontario Leads Canadian Provinces in Production of Stone

According to Dominion statistics, Ontario led all other Provinces in the production of stone in 1930, with 54 per cent. of the total tonnage quarried and shipped. There were 284 firms engaged in quarrying throughout the Dominion, with 226 plants operating solely on cutting and dressing stone for building or ornamental purposes. The majority of the quarries were in Ontario, which also had 118 of the plants. Many firms operate dressing works in conjunction with quarries.

In 1930 Ontario produced 5,396,000 tons of stone, of which 4,525,000 were limestone and 856,000 granite. Canadian production was 9,995,000 tons, of which 7,773,000 tons were limestone. Ontario limestone and granite are used chiefly in crushed stone for concrete aggregate, road metal and railroad ballast, although fairly large amounts go to dressed building stone.

Import data for Ontario are not shown separately, but that Province probably accounted for a good share of over \$1,155,000 worth of building stone imported from the United States in 1930. In the same year the Dominion exported crushed stone valued at about \$235,000 to the United States, but Ontario quarries were not an important factor in this trade.



The new fine-crushing and screening plant of the Kelley Island Lime & Transport Co. at Clay Center, O.

Operators Bend Efforts Toward Finding New Markets for Waste Stone

Few New Plants Built in Crushed-Stone Industry; Greater Trend Toward Washing

THE crushed-stone industry as a whole did considerably less business in 1931 than in 1930.

This is evident from reports received from producers in all parts of the country and from editorial observations.

In certain sections of the country business was unusually good and many plants worked 24 hrs. a day during the greater part of the year. A number of plant operators in these sections reported having the best year in their histories. In other sections, however, business was far below normal. Many plants in these sections operated at less than 25 per cent. of their capacity and some did not have enough business to justify operating at all.

This unusual situation was due to a great extent to the large highway and special construction projects going on in some sections. Building construction, usually a large market for the crushed-stone industry, was far below normal. This fact explains the poor business in those sections where no other large construction projects were going on. Sales of stone for railroad ballast were also smaller, due to decreased railroad-maintenance budgets.

The number of new plants built was considerably less than in 1930, which was one of the best building years in the history of the industry. Many of the new 1931 plants were located in the sections where business was good and were built in anticipation of this business. Others were built to re-

place older plants whose obsolescence and dilapidated condition made it impossible to operate them profitably at current crushed-stone prices. A number of plants were rebuilt during the year and many made minor improvements. The purpose of most of the expenditures made was not to increase capacity but to lower production costs and, in many cases, to improve the quality of the product to meet increasingly-strict specifications.

The problem of reducing the waste in crushed-stone plants received considerable attention. Many operators made additions to their plants for reducing undesired sizes of stone to sizes for which there is a market. Others installed washing or classifying systems for the production of stone sand and other fine sizes of limestone from what was formerly a waste product. Several companies actually installed crushing equipment to increase the amount of "fines" produced. Washing of ordinary commercial sizes of stone is on the increase and most of the larger new plants being built include provisions for washing their product.

Kelley Island Lime & Transport Co.

One of the outstanding new plants of the year is that of the Kelley Island Lime & Transport Co. at Clay Center, O. This is not a complete plant but is a fine-crushing and screening unit built to convert into marketable form the excess stone from

the crushing plant, which produces flux stone and stone for the five lime plants operated by the company at this same location. It can produce any eight sizes of stone between 2-in. and 100-mesh at one time and has a capacity of 140 tons per hr.

Features of the plant are its flexibility, permanence, cleanliness, and safety. It is entirely of concrete-and-steel construction. All dust-creating machinery is entirely inclosed. All machinery drives are fully inclosed and any other dangerous



The cone crusher at Kelley Island plant with feeder above.

moving machinery is inclosed or otherwise protected. Safety is further enhanced by the accessibility of every operating unit and the ample space around it.

Stone is secured from bins in the older primary crushing plant and taken by belt-conveyors to the top of the screening building. A magnetic pulley on one of these conveyors removes all tramp iron from the stone. Screening is done by three vibrating screens, the first a single-deck and the other



One of the vibrating screens at the Kelley Island plant. Inclosed dust screen at right.

two double-deck units. All sizes can go directly to bins, but usually the material passing through the 4-mesh screen goes to a rotary drier. The dried material is then conveyed and elevated back to the screen building, where it is sized by a triple-deck vibrating screen inclosed in a dust-proof room.

The larger sizes of stone can be recrushed if desired. These are diverted to one compartment of a 4-compartment bin feeding to a short-head cone reduction crusher. The recrushed stone is conveyed back to the original conveyor to the screen-house for rescreening. The other compartments in the crusher feed-bin may later be used to supply stone for a rotary lime kiln located in an adjacent building.

The reclaiming of stored material for recrushing is also provided for. Cars are loaded from the bins and discharged to a hopper. An apron-conveyor and an elevator discharge to the crusher feed-bin. Both car and truck shipments are made.



The new asphalt and dry-batching units at the Haverstraw, N. Y., plant of the New York Trap Rock Corp.

New York Trap Rock Corp.

The New York Trap Rock Corp., always one of the most progressive organizations in the crushed-stone industry, can usually be counted upon to contribute something of importance to the advancement of the industry each year. This company was one of the first to erect large, efficient, permanent plants, such as its operations at Haverstraw and Stoneco, N. Y. Nothing of this importance was done this year but some developments of interest to the industry were made.

The company has gone into the production of stone sand and during the year installed a number of centrifugal washing units in its plants. The first of these was installed at the Haverstraw plant and successfully turned out a product which easily passed the strict New York State specifications. Work was then begun on the installation of two such washers at the Stoneco plant, and the installa-



Concrete storage silos at Haverstraw plant with conveyor from main plant in background.

tion of another unit at Tompkins Cove is contemplated. Another type of washer had been installed at the Cedar Cliff plant previous to 1931, but it was not until the Haverstraw installation proved successful that the company went into this field on a large scale.

The Haverstraw plant was also the scene of another interesting installation. Early in the year an addition to this plant was completed for loading washed stone and dry-batched stone to trucks. Adjoining this unit a cold-mix asphalt plant was built. This is owned by an independent company which purchases aggregates from the stone company. Material for this new operation is taken from the barge-loading conveyor to a washer building. An inclined conveyor feeds the washed aggregate to an inclined conveyor which feeds to a distributing belt-conveyor. This discharges to seven 22-ft. by 60-ft. concrete storage-silos with a capacity of about 300 tons each. Trucks are loaded on one side of the silos. Gates on the opposite side feed to a horizontal belt-conveyor. This discharges to a bucket-elevator which discharges into the 4-compartment, 200-ton dry-batch bin. A by-pass at the head of the elevator allows stone for the asphalt plant to go to another belt-conveyor which discharges to the drier-feed bin. The oil-fired rotary drier has a capacity of 50 tons per hr. It discharges to a



The three sets of vibrating scalping screens at the Stoneco, N. Y., plant of the New York Trap Rock Corp.

bucket-elevator which in turn discharges to a triple-deck vibrating screen. The finished stone is stoned in four bins of 50-ton capacity each in the mixing plant. Asphalt is stored in a building alongside the plant. It is reduced to the desired size by a hammer-mill. Aggregate and asphalt are mixed in a 2-cu.yd. mixer which discharges directly to trucks. The plant has a capacity of 600 tons of finished asphalt per day.

Another change made by the New York Trap Rock Corp. during the year was the replacement of the four revolving scalping screens in the new Stoneco plant by four pairs of vibrating screens arranged in tandem. This plant was the largest and most up-to-date crushed-stone plant built in 1930



Loading stone to pans in quarry of Boscobel Granite Quarries, Inc.

and is probably the largest plant in the country producing only the regular commercial sizes of stone. The plant now uses vibrating screens exclusively, a total of 44 units in all.

Thunder Bay Quarries Co.

The largest and undoubtedly the most interesting crushed-stone plant built in 1931 was the new plant of the Thunder Bay Quarries Co. which went into operation late in the year. It was designed to pro-

duce six sizes of stone for boat delivery to industrial markets.

The plant is of unusual but simple design. Its chief features are the design of the screen-house and stocking bridge, which allow sizing and ground storage of the stone with remarkably few operating units. Skillful design, the use of large operating units, and the fact that the larger sizes of stone are the main products combine to give this plant simplicity without sacrifice of flexibility, efficiency, or capacity.

Boscobel Granite Quarries, Inc.

An interesting example of a small crushed-stone operation designed to fit existing local conditions is



Two coarse-sizing screens at Marble Cliff.

that of the Boscobel Granite Quarries, Inc., at Manakin, Va. The unusual method of hauling stone from the quarry to the plant is the main feature of interest.



Shovel loading truck at Brewster plant.

Existing conditions made it necessary to deepen the quarry below the plant level. Stone is loaded into steel pans on 4-wheeled trailers drawn by tractors. These are hauled to the face of the quarry nearest the plant. A derrick on the plant level hoists these pans and dumps the rock directly into the primary-crusher hopper.

The plant itself is of conventional design. Crushing is done by the jaw primary unit and recrushing by a cone crusher. A rotary scalping screen and 4 small double-deck vibrating screens produce 5 sizes of stone which are stored in a 5-compartment steel bin. Certain sizes can be fed to a belt-conveyor leading to a washing unit mounted on another 3-compartment bin. Washing is done by a cylindrical scrubber-screen. Trucks or cars can be loaded from either bin.

Marble Cliff Quarries Co.

The Marble Cliff Quarries Co. early in the year rebuilt its Plant X at Columbus, O., to a capacity of 750 tons per hr. of flux and chemical stone, with provisions for washing all material under $2\frac{3}{4}$ in. This addition uses vibrating screens throughout,



New plant of Boscobel Granite Quarries, Inc., at Manakin, Va.



New crushed-stone plant of Geo. M. Brewster & Son, Inc., at North Bergen, N. J. Dry-batching unit at left.

with the exception of the primary live-roll grizzly and the two 30-in. log-washers. The features of this plant are its flexibility of sizes, the ability to produce either dry or washed material and the additional provisions made for picking out clay balls where absolutely clean stone over $2\frac{3}{4}$ -in. size is desired.

Stone goes from the primary crusher to a roll-grizzly, "oversize" being recrushed in a secondary unit and sent back over the grizzly. The grizzly discharges to an elevator feeding two single-deck screens with $2\frac{3}{4}$ -in. openings which make the first separation. The "undersize" goes to the fine-screening and washing building. "Overs" go to two vibrating screens with 6-in. openings. The "oversize" from these units goes to a picking conveyor, where clay balls, etc., are removed. This stone can go to bins as chemical stone or can be sent back for recrushing.

"Undersize," $2\frac{3}{4}$ -in. to 6-in., goes either to storage or to two vibrating screens with 4-in. openings. Both sizes produced go to storage. The "throughs" can, if desired, be conveyed to the fine-screening

and washing building. Washing and sizing is done by two single-deck vibrating screens with $1\frac{1}{2}$ -in. openings and two log-washers. The $1\frac{1}{2}$ -in. to $2\frac{3}{4}$ -in. stone can be returned to the primary-crushing plant to be added to the flux stone, when this is too high in clay content, or to a third building, where the $1\frac{1}{2}$ -in. stone is also washed. A by-pass ahead of the two log-washers allows storage of either washed or dry stone of both sizes.

The $1\frac{1}{2}$ -in. stone goes to a double-deck vibrating screen for further sizing. The "undersize" minus $\frac{1}{4}$ -in. or minus $\frac{3}{4}$ -in., goes to a water-filled tank from which it is elevated to storage. "Oversize" is washed or stored dry as explained above. This installation was completed early in the year and was accompanied by improvements in other plants.

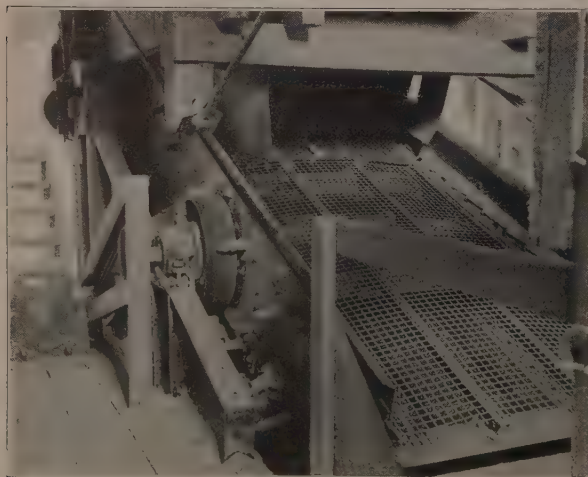
Geo. M. Brewster & Son, Inc.

Geo. M. Brewster & Son, Inc., last winter tore down and rebuilt its crushed-stone plant at North Bergen, N. J., making such a thorough job of it that the result can more accurately be called a new plant. The purpose of this work was to increase the plant capacity, decrease the operating cost and, at the same time, insure a high-grade product. The plant now has a capacity of 250 tons per hr. The timeliness of this improvement program is shown by the fact that the company in 1931 had the best year in its history.

All the old plant was torn down except the concrete storage-bins which were added to and form the foundation for the new screening building. The primary jaw crusher was relocated and a secondary gyratory crusher and cone crusher added. The old rotary screens were replaced with vibrating screens. Trucks are used to haul the stone from the quarry to the plant. Cars and trucks are loaded from these bins. A weigh-batching plant, erected during the previous year, is used for dry-batching to trucks.

Previous to the improvements made at this plant the company completed a large improvement pro-

(Continued on page 77)



One of the vibrating screens in the Brewster plant.



Hand-winch controlling discharge chute at top of Warner Co. plant.



Stationary aggregate-rinsing screens with selective chute over Warner Co. plant.

Ready-Mixed-Concrete Industry Advances Rapidly and Improves Product

**Many New Plants Spring Up During Year
Near the Larger Centers of Population**

ALMOST every important industry has made rapid progress during the past few years in its technology, in the economy and efficiency of its operations, and in the quality of its product. This is due in part to the fact that very little expansion took place in these industries during that time because of slackened business conditions which allowed more attention to be given to other problems of the industries than mere quantity production.

The ready-mixed-concrete industry, a new industry in point of years but already of great importance, has made exceptionally rapid progress along these lines during this period, due probably to a number of other factors in addition to the curtailment in business. This industry is an offshoot of the aggregate industries and as such has been able to take advantage of many principles and developments evolved in these industries through many years of experiment and practical experience. Among those connected with the ready-mixed-concrete industry are aggregate producers, contractors, engineers, testing laboratories, architects, cement manufacturers and others whose past connections with these industries enable them readily to apply their knowledge and experience to this new industry. Manufacturers of equipment for ready-mixed-concrete plants are also placed in an advantageous position because of their past connections with the aggregate and construction industries. In view of the above it is evident why this industry has reached such a high plane of efficiency in less than six years of active development.

Full credit for the progress of the ready-mixed-concrete industry must, of course, be given chiefly

to the aggregate producers and their associations, who have supported it from the start and who are responsible for the formation of the National Ready Mixed Concrete Assn. This body already has done much to advance the industry during the short time it has been in existence and shows promise of being an important factor in the development of the industry. Architects and engineers who have gained their technical knowledge of concrete in the construction industry are to a great extent responsible for the prevailing methods of concrete-design which have made it possible to produce a concrete of consistent quality. Material dealers, primarily salesmen and not engineers or producers, have contributed largely in the matter of improved methods of delivery and accounting.

Progress in the ready-mixed-concrete industry in the form of new plant developments was not affected to as great an extent in 1931 as development in most other industries, although the industry did not continue to grow quite as rapidly as in the previous year. Many of the new plants built were permanent and efficient operations showing the result of engineering skill and practical experience.

No particular trend was noticeable during the year toward either the central-mixing or mixed-in-transit type of operation, many plants of both types having been erected during the year. Many of the new plants were built for both types of operation, using the same batching equipment to feed the plant mixer or the truck-mixers. The mixer-trucks used in connection with these plants are used as agitator-trucks when centrally-mixed concrete is specified. Some of these plants can also handle dry-batched aggregates to batcher trucks when there is

a demand for this type of material. The advantages of a flexible operation of this type are obvious.

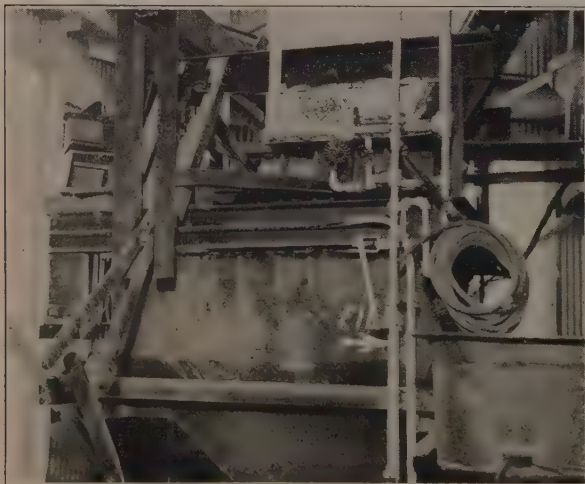
New plant developments during the year were not confined to any particular sections of the country. Plants were built in all parts of the country which have sufficient demand for concrete to justify the expense. The six plants discussed in this review are selected because they illustrate best the advances made by the industry and because they are representative of the various types of plants. It is only a coincidence that two of these plants should be located in California and one each in Texas, southern Ohio, eastern Pennsylvania, and eastern New York.

During the past year a number of plant operators in different sections of the country began experimenting with methods of shrinking the concrete before discharging it to mixer trucks. This shrinkage is accomplished by mixing the concrete, either wet or dry, for from 10 to 20 sec. in a concrete mixer. This method is said to increase the capacities of both the plants and the trucks without increasing the investment required. At least one plant designed for this type of operation has been completed and interesting developments along these lines should take place during 1932.

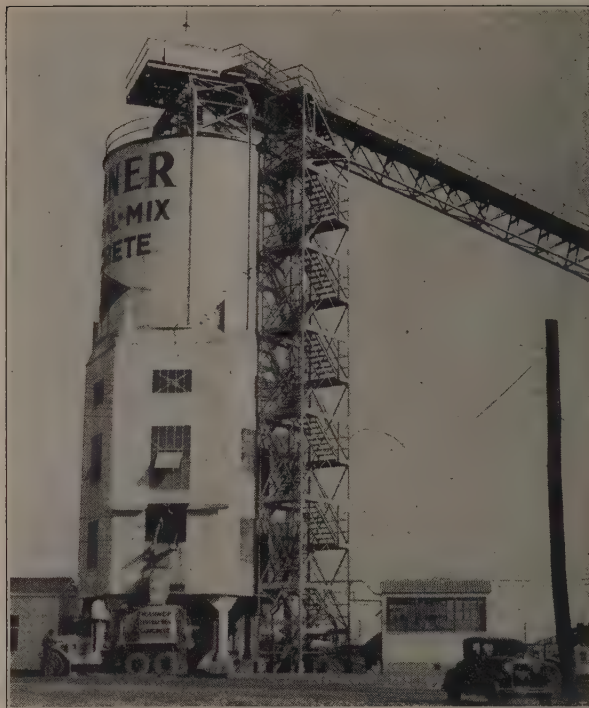
The Warner Co.

The Warner Co., one of the largest producers of ready-mixed concrete and one of the pioneers in this field, made an important contribution to the industry in 1931 by the erection of a new combined central-mixing and dry-batching plant at Morrisville, Pa. Many features of design and control distinguish this plant from most new plants.

Aggregates are brought in by car from a near gravel plant operated by the company. A belt-conveyor elevates the aggregates to the top of the plant, where they are rinsed over stationary screens before being discharged to storage-bins. The arrangement of these bins is unusual. Eight bins, one for cement and seven for aggregates, are arranged in circular form about a large circular water tank in the center. This forms a compact arrangement over the batching floor and has the added advantage



Batching equipment in Warner Co. plant.



New central-mixing plant of Warner Co. at Morrisville, Pa. Office at right.

that in cold weather the water is protected from freezing and is actually kept warm through radiation from the aggregate bins.

The batching floor has two separate batching systems. One consists of a single weighing batcher used for dry-batching directly into regular trucks.



Aggregate batcher and dial scale in plant of Fort Worth Sand & Gravel Co.

The other consists of two batchers, one for cement and one for aggregates, which feed to a 3-cu. yd. mixer. Concrete is delivered in agitator-trucks.

Fort Worth Sand & Gravel Co.

A new plant, which is the outstanding operation in the Southwest and one of the best anywhere, is that of the Fort Worth Sand & Gravel Co. at Fort Worth, Tex. In the variety of service it offers this

plant is also unique. Primarily a central-mixing plant, it is also equipped to handle dry aggregates simultaneously with the concrete, and can also serve as a batching plant for mixer-trucks or for regular trucks.

Aggregates for this plant are received from the company's gravel plant, are dumped to stock-piles separated by concrete partitions, and are recovered by a tunnel conveyor feeding to an inclined conveyor leading to the top of the dry-loading-bins. This conveyor can discharge either into this 6-compart-



Mixing arrangement at plant of Fort Worth Sand & Gravel Co. Swinging chute can be used to feed either mixer or to discharge directly into trucks.

ment 180-ton bin or to a conveyor leading to the top of the concrete plant.

This plant has a 5-compartment 150-ton bin. Batching is done in the usual manner, using separate batchers for cement and aggregates. A man-lift elevator is used for handling special cements in



Main conveyor and drive at Fort Worth plant.

sacks when these are required. Regular cements are unloaded in bulk to an elevator feeding to bins above the plant.

The weighing batchers ordinarily feed to a 2-cu. yd. mixer through a hinged chute. Should anything go wrong with this mixer, the chute can be readily swung to feed a 1-cu. yd. mixer salvaged from an older plant. Should occasion arise, this chute can discharge down between the mixers directly into trucks. This is made possible by the use of mixer-trucks which are ordinarily used as agitators.

Bode Gravel Co.

Another example of the development of this industry on the Pacific Coast is the new plant of the Bode Gravel Co. at San Francisco, Cal. This plant went into operation late in 1931 but some changes are now being made in the control mechanism.

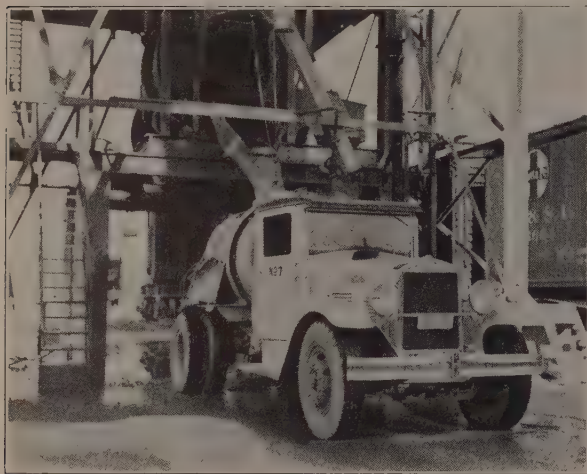
The plant has a capacity of 700 cu. yd. of concrete per day and can be used for either concrete or dry-



Plant of Fort Worth Sand & Gravel Co. at Fort Worth, Tex. Car of cement being unloaded at right. Office at left. Dry-batch plant in foreground.

batched aggregates. Aggregate bins, with a capacity of 1,200 tons, and cement silos of 4,800-sack capacity provide adequate supplies of material. Cement is handled in bulk by a pneumatic conveying system and aggregates by a belt-conveyor.

Materials are weighed automatically by a dial-scale fitted with an electrical device which records all measurements. All material handling is electrically-controlled from the batching floor and all operations in the mixing plant are controlled by air-



Mixer discharging to agitator truck at Fort Worth plant.

valves. This plant is one of the first to shrink the concrete in a mixer before loading to the mixer-trucks which finish the mixing. A 10-sec. mix at the plant increases the capacity of the truck-mixers approximately 30 per cent.

Readymix Concrete Co.

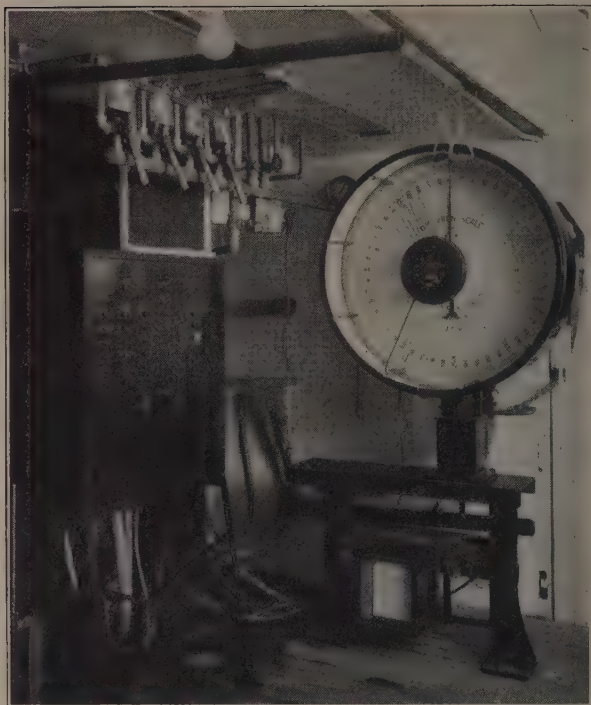
An example of the application of good engineering and sound practice to a central-mixing concrete



Plant of Bode Gravel Co. with cement-storage tank and unloading building at left.

plant is the new plant of the Readymix Concrete Co., San Francisco, Cal., which is fully described elsewhere in this issue. This plant has unusually complete storage facilities for seven sizes of aggregates, allowing the full advantages of low-water-ratio concrete design.

All the operations are automatically controlled in the concrete plant proper by compressed air and



Automatic dial scale with electrical recorder in plant of Bode Gravel Co. Electric push-button and air-valve control at left.

in the remainder of the plant by centralized electric remote control. Delivery of the concrete and the keeping of records in this plant have also been developed into an exact science.

Cincinnati Builders' Supply Co.

Another new transit-mixing plant of importance is that of the Cincinnati Builders' Supply Co. at Cincinnati, O. This operation is modern in every way and was one of the first to apply photoelectric-cell control to the automatic batching of cement.

The plant has unusually complete aggregate-storage facilities, due to the fact that it is located alongside an aggregate-storing and handling unit with a capacity of 66 car-loads. Aggregates are recovered from these bins by a belt-conveyor feeding

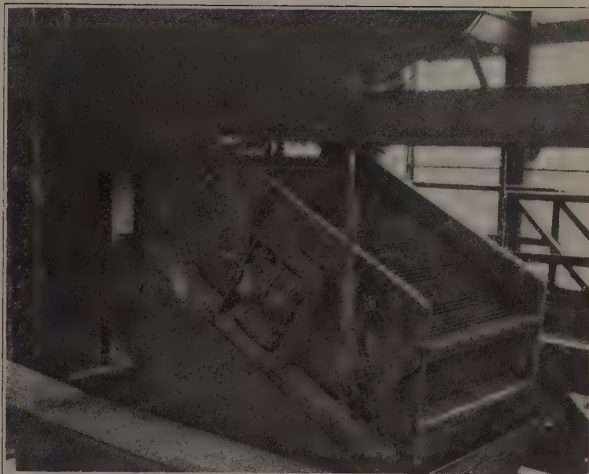


Weighing batchers of Cincinnati Builders' Supply Co. plant. Cement scale at right has photoelectric-cell control.

(Continued on page 77)



Head frame and skip-car at Birmingham Slag Co. plant.



One of the double-deck vibrating screens at Birmingham plant.

Five New Slag Plants Erected in 1931 Indicate Faith in Industry

**Operations Are Built in South and East
to Utilize By-Product of Blast Furnaces**

THE fact that, four new plants were put into operation during the year and that numerous improvements were made at other plants reflects the attitude of slag producers toward the prospects for this industry during 1932. One of the new plants, that of the Birmingham Slag Co., replaced another plant at the same location which was destroyed by fire late in 1930. The new plant of the Buffalo Slag Co., one of the largest in this industry, replaces two older plants. The third plant, that of the Cashion Slag Co., is a comparatively small operation. The fourth plant, that of the Standard Slag Co., is a medium-sized unit of modern design. These plants, therefore, did not increase the capacity of the industry to any considerable extent.

Birmingham Slag Co.

The Birmingham plant has many features which make it one of the most interesting new plants of the year. Perhaps the most important of these is its dust-collecting system which is one of the most complete yet installed in a slag plant. The Buffalo plant ranks as one of the largest in the industry and has other features of interest to other plant operators.

The new plant of the Birmingham Slag Co. at Ensley, Ala., as previously stated, was built to replace another plant which was almost completely destroyed by fire in Oct., 1930. Construction was begun almost immediately and the new plant put into operation early in 1931.

The concrete bins used in the former plant were retained and the superstructure was built entirely

of steel instead of the timber formerly used. No efforts were spared to make this plant as permanent and efficient as possible in every way. Its capacity of 300 tons per hr. also ranks it among the largest plants in the industry.

Molten slag is obtained from a near steel mill and is cooled in open pits from which it is recovered by an electric shovel and is then hauled in dump cars to the plant. A third-rail electric locomotive hauls the cars.

The material first goes to a live-roll grizzly with 2-in. openings, the "oversize" from which goes to a 7-ft. cone crusher set to a 2-in. opening. The material under 2-in. from both units goes to a 50-ton bin which feeds a balanced-type skip-hoist which in turn discharges to a 50-ton bin at the top of the plant. This skip is protected in every possible way against failure of any kind. The control includes the regular service brake, an emergency brake, electrically-operated slack-cable switches, limit switches and overspeed switches. Any failure in the equipment or on the part of the operator results automatically in the instant cutting off of power to the hoist motor and the setting of the brakes.

The slag is fed from the bin, over a magnetic separator which removes tramp iron, to a series of four double-deck vibrating screens. Rough sizing is accomplished by the first unit, which can discharge directly to bins, back to a 4-ft. cone crusher for further reduction, or to the other three screens for further sizing. An elevator returns the re-crushed slag to the screen. Ordinarily five sizes under and two sizes over 1-in. are produced and

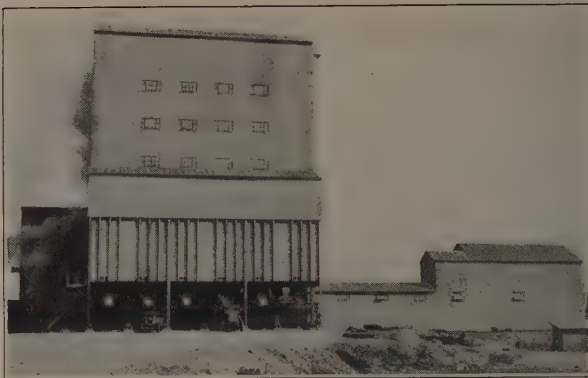
these are stored in 11 bins of 75-ton capacity each.

These bins load directly into cars. Under the bins there is a conveyor which can draw from them to a single-deck vibrating washing screen when a washed, dust-free slag is desired. The screen discharges directly into cars.

The dust-collecting system previously mentioned consists of a 44-in. fan, which collects the dust from the screens to a cyclone-type dust collector that discharges to a bin. All bins are closed on their tops to prevent the spread of dust. As the result of these precautions this plant is unusually clean.

Buffalo Slag Co.

The Buffalo Slag Co.'s new plant at Lackawanna, N. Y., a suburb of Buffalo, went into operation on Feb. 18, 1931, replacing the company's old Plant No. 2, which had been operated near there since 1919 and was shut down when the new plant went into operation. The original plant in Buffalo, built by the company 19 years ago when it first entered the slag business, was also shut down in 1931 as a result of the furnaces supplying it with slag having been abandoned. This plant, therefore, did not increase to any great extent the productive capacity of the company.

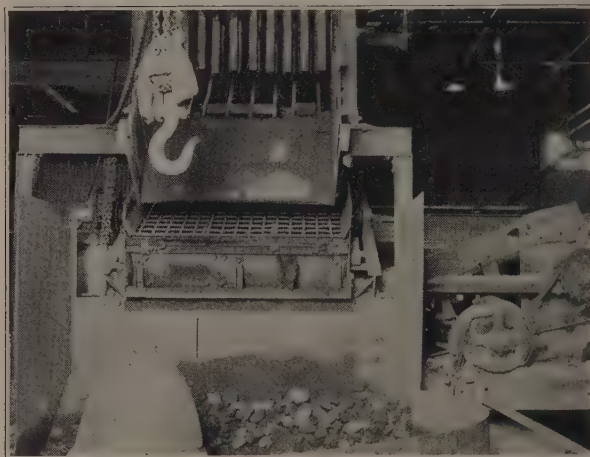


New plant of the Buffalo Slag Co.

The new plant is one of the largest in capacity, as well as one of the most efficient, in the slag industry. When operating at its full capacity of 400 tons per hr., only 9 men are required to operate it. Unusual precautions are taken to insure the removal of all possible iron from the slag and all breakage from the finished product. The construction of the plant is of the most permanent type, with concrete footings and foundations, steel



View showing steel and concrete construction of Birmingham plant.



Grizzly, scalping screen and primary crusher at Buffalo plant.

framework, floors and stairs and corrugated-metal siding and roofing. Ample provisions have been made for increasing the capacity of the plant at any time.

Slag for this plant comes from two near steel mills, where it is loaded into railroad cars by shovels. These cars discharge at the plant over an 18-in. rail-grizzly to a track hopper. This grizzly is the first separation point for iron, large pieces retained on it sometimes weighing as much as 2 or 3 tons. These pieces are taken away by an overhead hoist, which loads them into a special car for shipment back to the mills.

The material which passes through this grizzly goes by a series of conveyors to a second grizzly with 7-in. spacing. The material passing through the latter goes to a single-deck vibrating screen fitted with 4-in. wire cloth. The "oversize" from both the grizzly and the screen go to a gyratory crusher and from there to a belt conveyor with a

magnetic head-pulley which removes any iron that may be present in the slag. This discharges in closed-circuit back through the grizzly and screen. The material passing through the screen goes to a short conveyor with a magnetic head-pulley for removing iron. A bucket-elevator then takes the slag to the top of the plant.

Rough screening is done by a double-deck vibrating screen with 2-in. and 1½-in. openings. The two large sizes produced go to a rotary screen and the material which passes through the bottom deck



Revolving screen at Buffalo plant with two vibrating screens in background.

to a vibrating screen. From this point the sizing of the slag is done by four additional revolving screens and two additional single-deck vibrators. These are arranged in such a way that any desired sizes can be produced by merely making a few changes in screen sizes.

The storage-bin has six compartments with a capacity of 125 cu.yd. each. Trucks are loaded through side discharge gates. Cars are loaded under the bins with an arrangement for removing fine material caused by breakage while in storage. Stationary screens under the bin gates discharge



Elevator from scalping and crushing units to top of screening plant.



One pair of revolving screens at Buffalo plant.

their "oversize" into cars and the "throughs" to a series of conveyors feeding back to the screening plant.

The Cashion Slag Co., which in 1930 built a new and an outstanding plant at Donora, Pa., in 1931 built another at Scottsdale, Pa. This, however, is a much smaller unit and was built to fill a local demand. Trucks haul the slag to the plant, discharging to a gyratory crusher. An elevator feeds to a triple-deck vibrating screen which in turn discharges to three steel bins of 25-ton capacity for shipment.

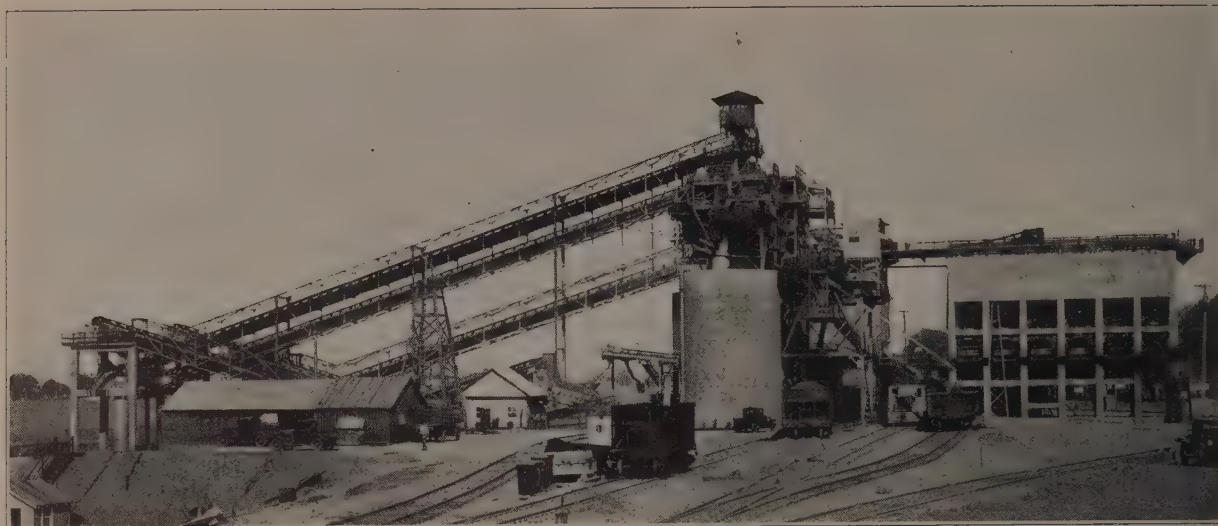
The new plant of the Standard Slag Co. at Holliday's Cove, W. Va., is an example of the company's long experience applied to a medium-sized slag operation. Only the best of equipment was used and the plant is a flexible unit of permanent construction.

The slag is scalped and crushed in the usual manner and sized by vibrating screens. Magnetic pulleys remove any iron in the slag during the processing. Five sizes are produced and are stored in bins. These can discharge either to trucks or to a mixing conveyor which can feed either single or mixed sizes to cars.

The Roquemore Gravel Co. entered the slag-producing field in 1931 with a new crushing and screening plant at Bessemer, Ala. Gyratory crushers, vibrating screens and magnetic separators are used in this plant which has a capacity of about 250 t.p.h.

Chee Hsin Cement Co. Prospers; Is Important Chinese Producer

The Chee Hsin Cement Co. appears to be one of the most prosperous manufacturing organizations in north China, and is apparently run on a sound and business-like basis. The trade depression which has affected most of the area in recent years has had only a minor effect on this company, and the officials are contemplating expansions of equipment and capacity. At present, about 40 per cent. of its cement output goes to Shanghai and another 25 per cent. is regularly consumed in Manchuria.

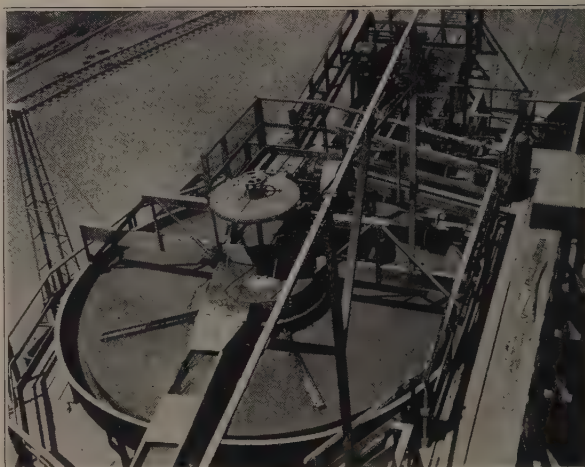


The new plant of the Kaiser Paving Co., at Radum, Cal.

Sand-and-Gravel Producers Complete an Impressive Building Program

Many New Plants Erected; Trend Toward Greater Adoption of Vibrating Screens

THE sand-and-gravel industry during 1931, according to figures available at this time, suffered a considerable decrease in production compared to 1930. Prices also were generally lower, with price-cutting in certain territories. As a result, the amount spent for repair, up-keep and replacement in existing plants in the industry also showed a decided decrease. This indicates that many operators, as in 1930, are postponing much-needed repairs and improvements as long as possible, awaiting an improvement in business before



Sand classifier at Kaiser Paving Co. plant.



Scalping screen, primary jaw crusher and cone recrusher at Kaiser Paving Co. plant.

making any but the most vitally necessary expenditures. In many of these plants, however, such expenditures can no longer be delayed and this should result in an increased demand for plant equipment during 1932.

One of the surprising things about this industry during the past year was the large number of new plants built. Except for one or two "boom" years, more plants were built than ever before in the history of the industry. This does not, of course, include portable plants operated by contractors for road construction, but only plants that are recog-

nized as "legitimate" operations. Many of the new plants were large, permanent operations of the highest type, reflecting the technical and engineering progress made by the industry.

These plants illustrate the increasing trend toward the use of vibrating screens both for coarse and fine separation. Many of these plants were completely equipped with vibrating screens and some also used rotary screens only for scalping or coarse sizing. The plants using only rotary screens were in the minority and did not include any of the more important new operations. A notable exception was the new plant of the Curtis & Hill Gravel & Sand Co. near Morrisville, Pa., which uses vibrating screens for scalping and rotary screens for sizing.



Scalping-and-crushing unit of new Sheridan plant.

modern plant using vibrating screens and bowl sand washers and classifiers; a large plant using vibrating scalping screens and rotary sizing screens; a small plant using stationary screens and cone classifiers; a modern plant producing road gravel only; and a sand-and-gravel dredge of an entirely new type.

Kaiser Paving Co.

The Kaiser Paving Co., one of the largest sand-and-gravel producers on the Pacific Coast, early in 1931 put into operation at Radum, Cal., what is unquestionably one of the outstanding plants of the year in this industry. It is capable of meeting the most exacting specifications for concrete aggregates. Features of the plant include: special sand washers and classifiers; the exclusive use of vibrating screens; the provisions for two complete washings of the gravel and rewashing before loading; the one-man push-button control; and the concrete and steel construction. The plant has a capacity of over 400 tons per hr., which can be doubled by the installation of additional equipment.

A brief description of the flow of material through the plant follows. Gravel is loaded by shovel into cars which dump to a hopper at the plant. A conveyor feeds to a vibrating scalping screen, oversize being crushed in a jaw crusher. Belt conveyors feed to the top of the screening plant onto two double-deck vibrating screens. Oversize from these goes to a bin feeding a cone reduction crusher. Sand is removed at several different points in the screening process. The plus- $\frac{3}{4}$ -in. and minus-



Two of the vibrating sizing screens at Kaiser Paving Co. plant.

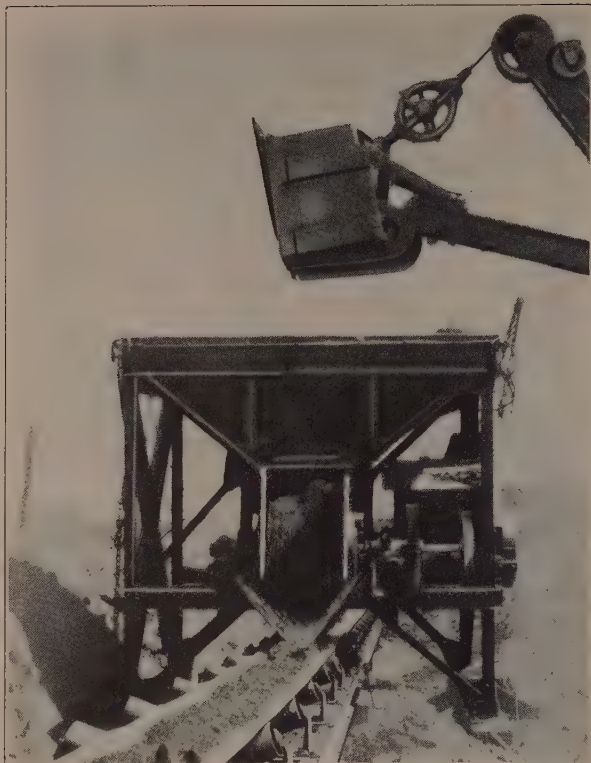
The new plants in every way present a cross-section of the industry. Geographically, almost every sand-and-gravel producing section of importance is represented. The various methods of winning the material from deposits and the most favored methods of preparing the product are all well represented.

Included in this review are brief descriptions of a number of sand-and-gravel plants built during the year which illustrate the various trends in the industry. These plants were selected for discussion more for this reason than because of their size or location.

The eight operations described include: a large



General view of new plant of the Sheridan Sand & Gravel Co. at Sheridan, Ill. Scalping-and-crushing unit at left, screening and storage unit at right.



Shovel loading to movable hopper on field conveyor of Sheridan Sand & Gravel Co. plant.

$\frac{3}{4}$ -in. gravel is split to two sets of screens for sizing. The sand goes to bowl washers and classifiers arranged to give any desired graduation. Gravel goes to six storage silos from which it is drawn, one size at a time, to six loading bins. The gravel is washed over vibrating screens under each of these bins and can be blended on a car-loading conveyor to any desired specification.

Curtis & Hill Gravel & Sand Co.

One of the newest and largest plants of the year was put into operation late in 1931 by the Curtis & Hill Gravel & Sand Co., at Morrisville, Pa. It is a dredging operation of about 400-tons per hr. capacity and has many distinctive features of design and operation. A complete and well-illustrated story of this plant is published in this issue.

Sheridan Sand & Gravel Co.

One of the outstanding new plants of the year was that of the Sheridan Sand & Gravel Co. at Sheridan, Ill. Features of this 250-tons per hr. plant are: The use of belt conveyors in the pit for all plant handling; the thorough provisions for producing cleanly-washed material; the stock-piling and tunnel-conveyor reclaiming system; the use of electric power generated at the plant; and the permanent concrete and steel construction of the entire operation.

Gravel is loaded by a shovel to a field conveyor which discharges to a hopper feeding a conveyor to the crushing and scalping building. Scalping is done by a revolving screen, oversize going to a gyratory



Conical coarse-sizing screens and vibrating fine-sizing screens at new Sheridan plant.

crusher. Another conveyor feeds to the screening plant where it discharges to two sets of three conical screens. Two vibrating screens do the fine sizing, the sand going to two sand drags for further separation.

The six sizes produced are stored in stock-piles separated by concrete partitions. These discharge, singly or mixed as desired, to a tunnel belt conveyor feeding to the washing and loading building. Here the gravel can again be washed on a single-deck vibrating screen. All of the power used is generated at the plant. A 210-hp. Diesel engine drives the main generator while a stand-by generator is driven by a 100-hp. semi-Diesel engine.

Kansas Sand Co.

A typical new plant built in 1931 is that of the Kansas Sand Co. at Topeka, Kan. Like most of the



General view of new plant of Kansas Sand Co. at Topeka, Kan.

other plants in this section, it is a dredging operation and has a simple shore plant with stationary screens and cone classifiers for sizing the material. Such a combination would seem to offer little opportunity for the application of original ideas to the design and operation of a plant. This operation, however, abounds with unusual features which combine to make this plant economical and efficient.

The dredge differs little from the average, being of the electrically-driven centrifugal type. A screen-nozzle insures efficient dredging. The hoist operating the dead-man and shore-lines is driven by a gasoline engine. This allows the dredge to be handled and brought safely to shore even should a sudden flood or other emergency cut off the electrical supply. Other features are an automatic oiling system for the ladder sheave and telephone communication with the plant. The pipe-line pontoons are also of an original type which prevent the formation of the drift jams which are a constant menace to river-dredging operations. The dredge-line is connected to the stationary shore-line by a flexible yet solid A-frame which allows operations to be carried on through a variation of at least 15 ft. in the river level.

The dredge-line discharge box at the plant has four removable stationary screens which remove all driftwood and oversize. A spread table feeds the gravel over two stationary screens which scalp off road gravel. These screens are removable and a baffle-board arrangement allows all of the material to be sent over one screen while the other is



The conical classifiers at the Kansas Sand Co. plant.

ing and belt conveyors for plant transportation. The capacity of this operation is about 250 t.p.h. It was built to replace an old plant with the purpose of securing greater capacity at a lower operating cost. The flow of operations in this plant is somewhat out of the ordinary.

Gravel is loaded in the pit by a shovel into cars which are hauled to the plant by a gasoline locomotive. A feeder discharges the gravel from the track hopper to a belt conveyor to the top of the plant. Clay is removed on a picking conveyor. Fine sizes are removed by a double-deck vibrating screen and



Shovel, locomotive and cars used at the Western Sand & Gravel Co. plant.

being changed, without shutting down operations. Material passing through these screens goes to three cone classifiers for further sizing. The type of classifiers used differs from the average in design. A vortex is created by the manner in which the flow is fed to it, and a special baffle design insures accurate sizing. Although almost entirely built of steel, this plant is semi-portable and can be moved and rebuilt at another location.

Western Sand & Gravel Co.

A new plant for the production of road gravel exclusively was put into operation early in the summer by the Western Sand & Gravel Co. at Spring Valley, Ill. Vibrating screens are used for all siz-



Main conveyor to screening building and return conveyor from crusher at Western plant.

stock-piled by a conveyor. Road stone goes to the loading plant. Oversize goes to a second double-deck screen which does the final sizing. The material through the bottom deck goes to the loading plant, and the oversize to a primary jaw crusher. The product of this crusher and the material retained on the lower deck of the screen go by conveyor to a cone secondary crusher. Another belt conveyor feeds to the main conveyor to the screening plant.

Gifford-Hill Co.

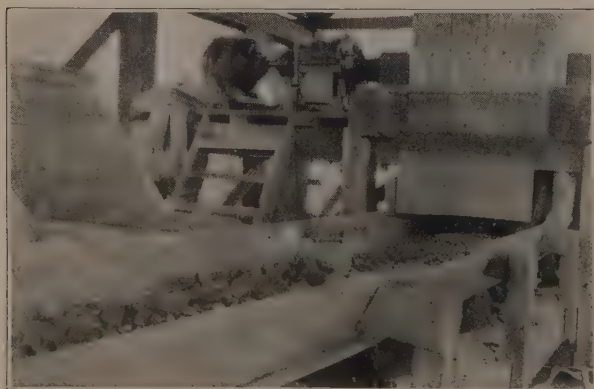
The Gifford-Hill Co., one of the leading sand-and-gravel producers in the Southwest, late in the summer put into operation a new plant at Roanoke, Tex. This plant has a capacity of only 50 to 60 tons per hr. but is included in this review because of some unusual features of operation and because it is a semi-portable plant of a type found only in a few sections of the country. This plant was built to supply aggregates for a large highway construction program and will probably be moved to another location when this work is completed.

Gravel is loaded into trucks by a shovel. The trucks discharge at the plant to a water-filled sump from which the gravel is fed to the plant by a dredge pump. Foreign material is picked out on a short belt conveyor and aggregates are sized and washed by a revolving screen and a sand drag. The plant has concrete foundations and timber framework which is bolted so that it can be taken down easily.

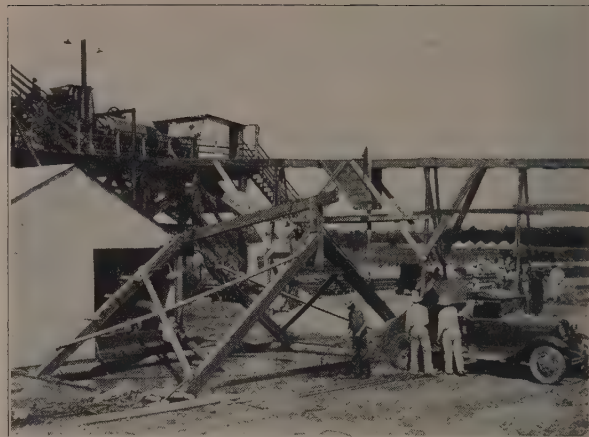
Material Service Corp.

The Material Service Corp. during the year made further improvements and extensions to its plant at Lockport, Ill. The sized material at this plant is stored in stock-piles separated by concrete partition walls and, as originally designed, this material is recovered by a belt conveyor in a concrete tunnel under the stock-piles and loaded to boats and barges. The new improvements were made to facilitate truck shipments.

This tunnel conveyor was extended 33 ft. at what was formerly its tail end and a reversible two-speed drive installed. It now discharges at this end to a 238-ft. belt conveyor which discharges through a gravity scalping screen. The material through this screen is wasted and that passing over it goes to a



Main conveyor drive and picking conveyor at Western Sand & Gravel Co. plant.



Truck discharging to dredging sump at new Gifford-Hill Co. plant.

60-ft. shuttle conveyor which discharges to the new concrete truck-loading silos.

The tunnel conveyor has a capacity of 1,000 tons per hr. when loading for water shipment and 500 tons per hr. when delivering in the opposite direction to the truck-loading silos. As the plant was originally designed with a future installation of this kind in mind, no other changes to the plant were necessary.

O'Brien Bros. Sand & Gravel Corp.

A sea-going sand-and-gravel dredge of an entirely new type was put into operation by the O'Brien Bros. Sand & Gravel Corp., one of the largest producers on the Atlantic Coast. This boat dredges from the ocean bottom and has an intake pipe which can be removed and put on deck when the boat is in motion. The material is then dewatered, scalped, screened and discharged to hoppers in the hold. It is recovered by belt conveyors and elevated to the deck where it is unloaded by transverse belt conveyors.

The boat is 427 ft. long and has a capacity of 7,000 tons of gravel which can be unloaded at the rate of 2,400 tons per hr. Two 20-in. dredge pumps are used and sizing is done by twelve vibrating screens. The boat can deliver its finished product at any point in New York or its vicinity where any other type of boat can unload.

Construction Materials Co.

Progress on the new plant being erected by the Construction Materials Co. at Ferrysburg, Mich., is being watched with interest by other operators. Construction on this plant was begun more than a year ago, and it is expected to be in operation by April 1, 1932. This plant will be the largest gravel plant in existence, with a capacity of 1,400 to 1,500 tons per hr.

Gravel will be dredged and hauled to the plant in barges. The plant is equipped with vibrating and shaker screens throughout, 29 of these units being used in all. Provision is made for recrushing oversize and an original system of sand washing and classifying is being developed. Boats will be loaded at a rate of 3,000 tons per hr. or more and similar facilities are provided for car-loading.



New lime plant of California Chemical Corp. at Newark, Cal. Hydrator building at left; kiln building, center; and washing plant at right.

Lime Industry Shows Some Gain; Prices Hold Up Well During Year

New Plants Built and Additions to Former Operations Made; Others Planned for 1932

CONDITIONS in the lime industry in 1931, for the first time in several years, showed some improvement, in spite of the fact that production for the third successive year was again considerably less than in the previous year. This loss was principally due to the falling off in construction work, where a large part of the lime produced is normally used. Indications are that the demand for lime for other purposes is increasing and that, with an increase in building construction to somewhere near its normal level, the lime industry can look forward to better conditions. Prices showed

very little if any decrease from those prevailing in 1930. This alone is encouraging, as prices in the lime industry have shown a steady decline since 1923.

Many lime plants made major improvements during the year and many more are planned for 1932. Several new plants or plant units went into operation and a number of others are planned. An interesting fact is that the bulk of this improvement program is west of Mississippi River, with the Far West and the Pacific Coast showing surprising activity.



Steel storage silos at new hydrating plant of Kelley Island Lime & Transport Co.



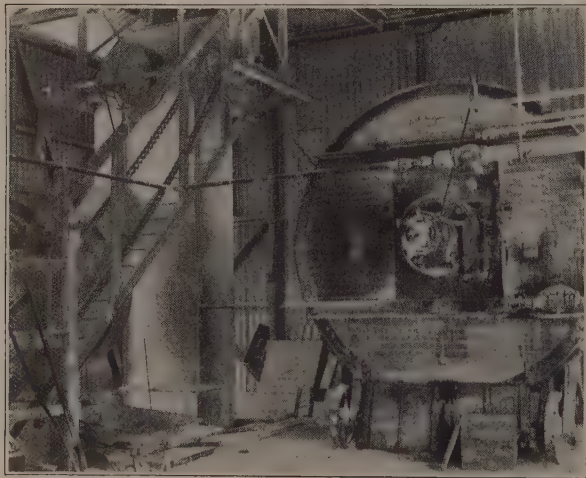
New mixed-feed kiln plant of New Process Lime Co., Tucson, Ariz.

Some of the more important developments follow. The United States Gypsum Co. installed equipment for the grinding of industrial stone at its Genoa, O., lime plant. The White Rock Quarries Co., Bellefonte, Pa., added four new vertical kilns to its plant, making it a 22-kiln operation. Important improvements were also made at the Ste. Genevieve, Mo., plant of the Ste. Genevieve Lime & Quarry Co.

The new plant developments include the following. A new hydrate plant was built by the Idaho Lime Co., Boise, Ida., replacing a former unit which had been destroyed by fire.

The New Process Lime Co., Tucson, Ariz., built a new one-kiln plant which is interesting for several reasons. The plant is of unusually modern concrete-and-steel construction for an operation of this size. The kiln is of original design, with an inside diameter of 3 ft. at the top and 10 ft. at the hot zone, and is 40 ft. in height. It is a mixed-feed kiln with a capacity of about 10 tons per day and is probably one of the smallest kilns of this type in existence.

The Kelley Island Lime & Transport Co. at Clay Center, O., in February, 1931, completed a new hy-



Firing end of rotary kiln at California Chemical Corp. plant.

drating plant for its Plant B. This is one of the most up-to-date units of its kind, being built entirely of concrete and steel. All machinery and drives in this plant are completely inclosed, making it an unusually safe and dustless operation. This unit has a capacity of 100 tons of finishing hydrate per 8-hr. day, which is equal to the kiln capacity of Plant B for 24 hr. The lime is burned in vertical kilns, picked, and delivered to a hammer-mill in the new hydrating building. Hydrating is done in two 1½-ton batch hydrators, after which the lime goes to two ball-mills for finish grinding. The finished hydrate then goes to two 4-tube bag packers or to three 1,000-ton storage-silos. A vibrating screen is used to insure against the presence of lumps in the lime when it is reclaimed from storage.

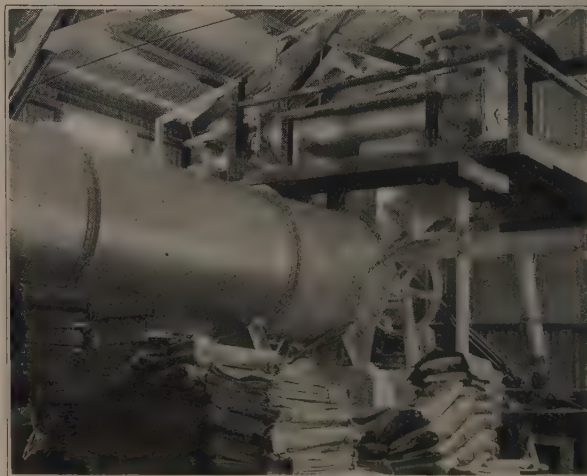
Another new plant which went into full production early in the year was that of the California Chemical Corp. at Newark, Cal. This is a modern rotary-kiln lime plant using oyster shells for raw



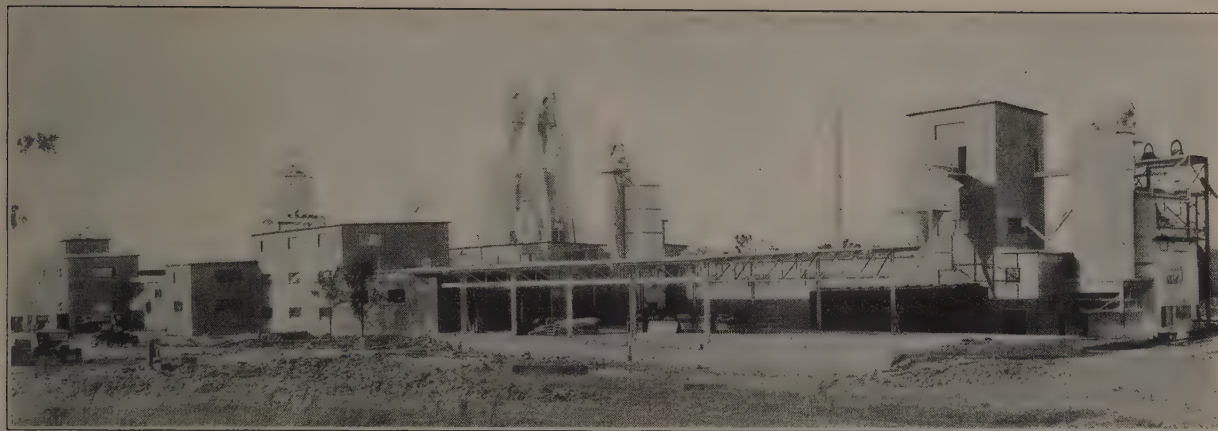
Pulverizer, packer, and hydrator at California Chemical Corp. plant.

material and was built primarily to furnish lime for a chemical plant operated by the company on the same property. The oyster shells are dredged from San Francisco Bay and washed both on the dredge and at the plant. They are allowed to dry before being fed to the 6-ft. by 8-ft. by 80-ft. rotary kiln. The kiln is oil-fired and is kept at an unusually high temperature to develop certain physical properties of the lime for chemical purposes. Provisions are made for temperature readings both at the center of the kiln and at the stack, allowing accurate control of the burning. The lime is cooled in a 5-ft. by 20-ft. rotary cooler and is then conveyed to a storage-tank over the hydrating building. Lime can be fed from this tank either to a car-loading system as quicklime or to a continuous hydrator in the plant which has a capacity of 2½ tons per hr. Hydrated lime goes to a pulverizer provided with air-separation before passing to a 2-bag packer.

In Canada the Canadian Gypsum Co. acquired the Standard White Lime Co. with a plant at Guelph, Ont. Improvements, including the erection of five new kilns, were made. This plant is now known as the Standard White Lime Co. Division of the Canadian Gypsum Co.



Another view of hydrator at plant of California Chemical Corp.



New gypsum plant of Canadian Gypsum Co. at Hagersville, Ont., with mine head frame at right.

Gypsum Industry Develops New Products to Help Maintain Production

Producers of Rock Asphalt, Silica and Feldspar Also Had Fair 1931 Business

DEPRESSED business conditions prevailing throughout 1931 had little effect on developments in many of the so-called minor non-metallic-mineral industries. Some of these industries have in fact had extremely good business during the past year and have built new plants or enlarged old ones to provide sufficient capacity to meet demands. Some of these new plants are good examples of modern plant design. Among those discussed in this review are the outstanding new gypsum, custom-grinding, filter-clay, silica-sand, rock-asphalt and feldspar plants.

Developments in the gypsum industry in the United States during 1931 were confined largely to the improvement of present products and the introduction of a number of new products. No plant developments of importance were made in this country.

In Canada the Canadian Gypsum Co. was particularly active. On Feb. 1, 1931, a new gypsum wall-board plant was opened at Hillsborough, N. B. On Nov. 1 the new plant at Hagersville, Ont., in the Caledonia gypsum district went into operation. This unit includes a mine, modern calcining mill, warehouse, board plant and block plant. All buildings are of modern fire-proof construction.

The Hagersville gypsum deposit, which is just south of Caledonia on Highway No. 6, was discovered by the Canadian Gypsum Co. geologist. The gypsum is of exceptionally fine quality and apparently of uniform excellence throughout.

The vertical shaft extends to a depth of 88 ft. and is operated with balanced cages. The mine, which is of the usual room-and-pillar type, is equipped with roller-bearing mine cars. The mining operation consists of drilling the face of the

rock with air-operated, mounted drills and shooting it down with low-strength dynamite, exploded by fuse; then conveying the loose rock to the crusher.

On reaching the crushing plant, the rock is reduced by a primary single-roll crusher, and the over sized rock is reduced by a double-roll crusher. Vibrating screens are used for grading. The rock is then transported by bucket-elevators and belt-conveyors to a rotary calciner of the most modern type.

After the calcined gypsum has cooled, it is conveyed to the board or the block plant or to the warehouse bins. In the warehouse the retarder, hair and other necessary ingredients are weighed and mixed in, and the finished material is then bagged by Bates packers.

The gypsum board machine and kiln is of the company's standard continuous type and is equipped with every modern device for manufacturing high-quality board products. The same may also be said of the block-plant equipment. An interesting feature is the movement of coal and stucco from the bins to the points of use by means of pneumatic conveyors. This plant is equipped to manufacture the company's complete line, which includes various kinds of plaster, wall-board and partition and roof tile.

Arrangements have been made for handling these products promptly and economically in mixed cars as well as in straight cars. Adequate trackage extends from the Canadian National Ry. and excellent trucking facilities also have been provided.

The U. S. Gypsum Co. during the year brought out some new products which include the following: Hydrocal, a product of unusual hardness used for mastic floors; tongue-and-groove floor tile over

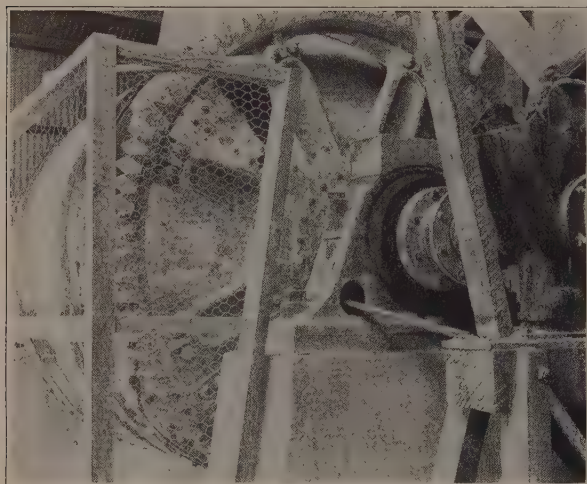
which any form of floor topping may be used; Sheet-rock paneling, a real wood veneer mounted on a base of Sheetrock; and Red Top insulating tile-board. An improved steel roof deck and other products were also developed.

Plant improvements were made in two U. S. Gypsum Co. plants. At the Ft. Dodge, Ia., plant gas-burning equipment replaced coalburners. At Alabaster, Mich., grinding equipment was installed for the manufacture of Terra Alba, a high-grade finely-ground gypsum used for industrial purposes.

The Arizona Gypsum Plaster Co., which operates a plant at Douglas, Ariz., opened an open-pit mine in a deposit acquired during the year some distance north of Douglas.

American Development Co.

The new custom-grinding plant of the American Development Co., Ltd., at Berkeley, Cal., is an example of what can be done even during a business depression by applying initiative and foresight to the conduct of a business. This company, instead of marking time and patiently awaiting the com-



Conical mill at American Development Co.

ing of a better business era, has gone out and brought in the business. This policy has been so successful that a constant expansion program has been necessary. The first grinding plant was put in operation late in 1930 and was so successful that work was immediately begun on a second unit which

began operating early in 1931. A third unit was completed late in the fall and a fourth is now being planned.

The company was originally formed to develop mines in Nevada and sell the crude ores mined. These included barytes, tungsten, alunite, feldspar, bleaching-clay, and volcanic-ash deposits. A natural step was for the company to go into the business of grinding and marketing these products. This business is supplemented by grinding to order material furnished by others. Other minerals are also purchased from other producers and ground to sizes for which there is a market. With this three-way



View showing two of the three plants of the American Development Co.

system of raw-material supply the company is able to obtain any desired material and is also enabled to keep its plant in steady operation. The plant is now grinding 33 different materials and is equipped to handle at least 15 others should a demand for these arise.

All the plants are located on the same property in an industrial section of the city with ample space for future expansion. Raw material is received by rail and shipments are made by rail, truck, or water.

Plant No. 1 is the largest of the three and can grind the greatest variety of products. Material first passes through a 24-in. jaw crusher to storage-bins so arranged that the material can be processed in any of a number of circuits. If further reduction

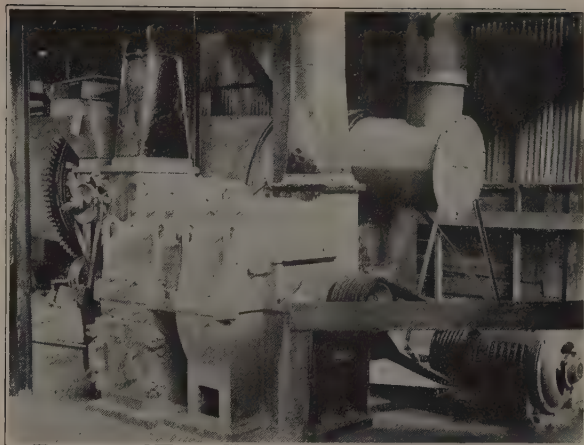


General view showing two large warehouses of American Development Co. with several of plants visible in background.



Rotary drier in plant of Olancha Mineral Products Co.

before grinding is desired, the material goes to a 24-in. double-roll crusher and back to the bins. Either of two grinding circuits can then be used. A high-side 5-roller mill is equipped with a natural-gas-burning furnace for material with a moisture



The pulverizer at Olancha plant with rotary drier in background.

ley before being sacked. Provisions are also made for the removal of undesirable foreign matter from any of the material after it leaves the roll-crusher. This is done by a revolving screen, a jig-type washer and a drag classifier.

Plant No. 2 is a distinctly different type of operation. All material received goes first to a 16-in. jaw crusher. This feeds to either of two bucket-elevators, one for dry and the other for wet material. The grinding-plant elevator discharges to two 50-ton bins which feed a 6-ft. by 18-ft. single-compartment tube-mill. Another elevator feeds a 14-ft. mechanical separator for separation before sacking. A CO₂-gas fire-protection system is an unusual feature in this plant.

The wet elevator discharges to a 200-ton bin, from which a screw-conveyor feeds to an indirect-heat oven drier with a 50-ft. tunnel, through which the material is passed twice on pan-conveyors. The heated air in this drier is closed-circuited by a fan and pipe. The drier discharges to cars which carry the material of either of the three grinding plants as desired. This drying system is used for material containing more moisture than can be removed in Plant No. 1.

Plant No. 3 is very similar to Plant No. 2 except



New filter-clay plant of Olancha Mineral Products Co.

content of up to 20 per cent. which is to be dried before it is ground. A cyclone separates the product of this mill before it is sacked. The other grinding unit is a 7-ft. conical mill which also has a separator.

Any product from either of these mills containing iron impurities is passed over a magnetic pul-



New silica-sand plant of Virginia Glass Sand Co. at Gore, Va.

that it is slightly smaller. Grinding is done by a 4-ft. by 16-ft. tube-mill and the product is separated by a mechanical separator. This grinding plant is also a complete unit with its own storage-bins and sacking arrangements.

Olancha Mineral Products Co.

The filter and bleaching-clay industry is well represented by the new plant of the Olancha Mineral Products Co. in Los Angeles, Cal. This plant is unusually compact and efficient in operation.

The raw material, which is similar to fuller's earth, is brought to the plant from a deposit 200 mi. away. At the plant it is unloaded and fed to a bucket-elevator which in turn feeds a small hammer-mill. The product goes to a 5-ft. by 10-ft. gas-fired indirect-heat rotary drier. Another bucket-elevator feeds the dried material either to mill feed-bins or to a series of three 3-ft. by 4-ft. magnetic screens, whence the finished material goes to a storage-bin and the coarse material to the mill feed-bin.

This bin feeds an impact pulverizer which is provided with a cyclone for recirculation of the "over-size." The finished material goes to a bin which feeds a 1-tube bag-packer. The exhaust air goes to two multiple-tube dust-collectors from which this



New rock-asphalt plant of Texas Rock Asphalt Co. near Cline, Tex.

product is sacked direct. A well-equipped laboratory controls the quality of the product which is used for filtering and bleaching mineral, vegetable and fish oils.

Virginia Glass Sand Co.

One of the few important developments of the year in the silica-sand industry was the erection of a new plant by the Virginia Glass Sand Co. near Gore, Va. Most of the product of the plant is used in the glass industry.

The rock is hauled from the quarry to the plant in cars which dump to a 14-in. by 24-in. jaw crusher. This reduces to 2 in. and less and discharges to a 9-ft. wet-type chaser-mill for further reduction. Two 6-ft. by 2½-ft. rotary screens return the "over-size" to the mill. The material passing the screens goes to two sets of four 22-in. screw-washers



Electric vibrating screens at Virginia Glass Sand Co. plant. arranged in series. A conveyor carries the washed sand to a 15-car bin.

Wet sand can be loaded from this conveyor direct to cars or can be fed from the bins to a conveyor below which feeds to a steam-pipe drier. Dry sand flows to a series of conveyors and elevators. In this series two magnetic separators remove any iron present. The dry sand then goes to two mag-



Loading chutes and conveyor for recrushing at Texas plant.

netic screens for final separation before going to storage.

A new plant was also put into operation during the year by the Ohio Quartz Products Co., Jackson, O.

Texas Rock Asphalt Co.

One of the few developments of the year in the natural rock-asphalt industry was the erection of a new handling and storage plant by the Texas Rock Asphalt Co. near Cline, Tex., in the well-known Uvalde rock-asphalt district. The raw material is a limestone impregnated with from 9 to 12 per cent. of bitumen. This is quarried and then hauled to the plant by trucks. The 21-in. by 42-in. single-roll primary crusher reduces it to 7-in. size and under and discharges to a bucket-elevator. A horizontal belt-conveyor with a traveling tripper distributes to a 1,000-ton steel bin. Cars can be loaded direct

from the bin, which can also feed to a belt-conveyor supplying a hammer-mill pulverizer which reduces the material to $\frac{1}{4}$ -in. and under to meet state specifications.

Southern Feldspar, Inc.

The new plant of Southern Feldspar, Inc., a subsidiary of the Golding-Keene Co., is the third plant to be built by this company. It is located at Toecane, N. C., and is entirely a processing plant, as all the raw feldspar used is purchased from local farmers. Although actually completed late in 1930, this plant was not in full operation until early in 1931.

Preliminary crushing is done by a small jaw crusher, and a belt-conveyor carries the product to a bin in the grinding mill. Grinding is done by two 8-ft. by 10-ft. tube-mills using pebbles for grinding. Both discharge to a bucket-elevator which feeds either to a 14-ft. centrifugal separator or to a 4-ft. by 5-ft. magnetic screen according to the fineness of product desired.

Erwin Feldspar Co.

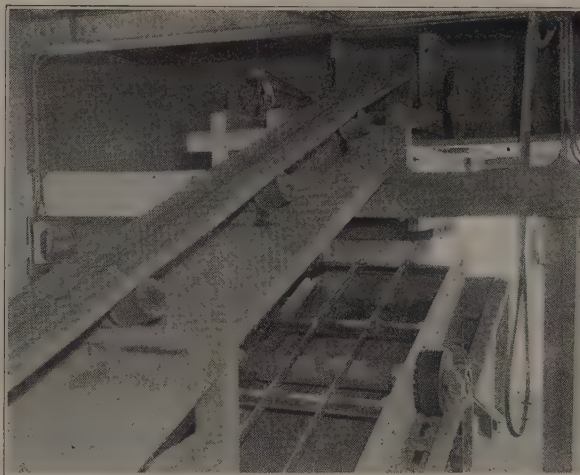
The Erwin Feldspar Co., a division of the Consolidated Feldspar Corp., early in the year completed extensive improvements to its plant at Erwin, Tenn. This is now not only one of the largest feldspar plants in existence but has many features of interest. One of these is a system of uniformity control which enables the company to furnish a product to meet any specifications. The operations of this plant are almost entirely confined to fine grinding.

The company mines its own spar. A primary jaw crusher and a secondary roll-crusher reduce the spar to about 8-mesh, when it is fed to a series of 30 silos for the various types of spar being handled. Analysis of the content of each bin is made. Five conical mills and a tube-mill grind the material to

Crushed Stone in 1931

(Continued from page 58)

gram at its yards in Bogota, N. J. This is now one of the largest and most complete building-material supply yards in existence. At this yard the company has a complete hot- and cold-mix asphalt plant, a stone-washing plant with a capacity of 100 cu.yd. per hr., and a concrete plant, with two 3-cu.yd. mixers, which has a capacity of about 1,200



Dust screen at Brewster plant with belt conveyor feed from coarse screens.

cu.yd. per day. In the concrete-plant building there are also facilities for dry-batching aggregates which are probably unequalled in this country.

A new plant erected by the Louisiana Quarry Co., Inc., Winnfield, La., went into operation early in the spring. This plant has a capacity of about 200 tons per hr. and was built to furnish 1,000,000 tons of stone for Louisiana road construction within a period of 15 months. The ability of the plant to fulfill this contract is evident from the fact that about 670,000 tons was produced up to the first of this year.

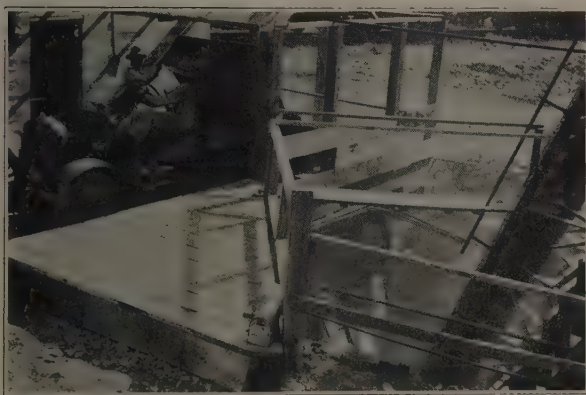
Ready-Mixed Industry Advances

(Continued from page 62)

an elevator which discharges to four 100-ton bins over the batching plant. Bulk cement is unloaded from cars to a 2-compartment bin over the plant by a pneumatic conveying system.

Separate cement and aggregate-weighing batchers are used. Each is fitted with a beam-scale, the aggregate batcher having a tell-tale dial and being controlled by the operator. The cement-weighing scale has a photoelectric-cell which shuts off the feed of the cement automatically when the desired amount of cement has been weighed. The truck driver then controls the flow of the batched materials to the mixer-truck.

The Cranford Material & Sand Co., Brooklyn, N. Y., early in the summer of 1931 put into operation a new plant for batching to mixer-trucks. A complete and well-illustrated story of this plant appears elsewhere in this issue.



Truck discharging to primary crusher at Texas Rock Asphalt Co. plant.

any specifications. Vibrating screens and mechanical separators are also used in the processing. Provisions are made to dry the spar if necessary before it goes to the silos. Three magnetic separators and a number of magnetic blocks at various points in the flow of the material insure the removal of any iron present in the spar.

Bureau of Mines 1931 Achievements Revealed in Report

THE incessant campaign for safer conditions in the mineral industries conducted by the United States Bureau of Mines was greatly stimulated in 1931 by the fact that the accidental-death rate in the mines for the fiscal year was one of the lowest on record, states Scott Turner, Director of the bureau, in his Annual Report to the secretary of commerce. In the first half of 1931 only three major explosions, exacting 41 lives, occurred in the bituminous-coal mines of the United States. None occurred during the months of February, March, April, May and June. An outstanding accomplishment of the bureau was the giving of 112,220 full courses of training in first-aid or mine-rescue instruction to mineral workers. To date the bureau's forces have given these courses of safety training to 581,982 persons in the mineral industries.

Continued experience has confirmed the opinion that the permissibility method of control of explosives for use in coal mining, introduced some years ago by the bureau, has operated with marked success as a safety measure. Recent statistics show that 56 per cent. of the explosives consumed are used for purposes other than coal mining. It remains now to aid metal mining, quarrying, and other engineering operations in which these other explosives are used by the creation of a stability list for the promotion of safety and efficiency in these industries.

The bureau's first-aid and mine-rescue training courses were given in 638 communities in 39 states and Alaska. Pennsylvania led with 24,657 persons trained, West Virginia was second with 12,092, Alabama third with 9,553 and Kentucky fourth with 7,834.

Individual states, notably Pennsylvania, Alabama, and Kentucky, had splendid mine-safety records during the year. Pennsylvania bituminous mines have not had a major explosion for more than two and one-half years, breaking all known records in this respect. Individual mines—coal, metal and nonmetal—have worked for long periods, (months, and in some instances well over a year) without the occurrence of a single lost-time accident. Generally the mines, mining companies, and states that are establishing these fine safety records are those coöperating closely with the personnel of the bureau. There is now good reason to believe that mining will soon take its place with the railroads and other industries which have shown that industrial work can be done with due regard to the health and safety of those engaged in it.

Outstanding instances of the operation of mines and quarries with perfect safety records, or with unusually low accident rates, were revealed by a safety contest conducted by the bureau, based on a statistical study of accident and employment reports submitted by all competing companies. Three

hundred and thirty-seven mines and quarries participated in the contest; of this number, 72 plants were operated without a serious accident to any employee.

Government drilling has demonstrated the wide distribution of potash minerals in the salt beds of New Mexico and Texas, since potash was found in every hole drilled. The occurrence of beds of mineable thickness sufficiently rich to be of possible commercial interest has been proved. Several areas favorable for commercial development have been indicated.

The study of methods of mining the numerous important nonmetallic minerals is proving useful in disseminating technical information among operators whereby they may analyze their own results, compare them with others, and, by adopting more efficient practices, lower operating costs and lessen wastage. The minerals studied include stone, sand and gravel, fluorspar, and feldspar.

The results of experimental work previously performed by the bureau on the flotation of fluorspar and rhodochrosite has been commercialized. During the year the bureau extended its list of nonsulphide ores concentrated by soap flotation; barite, siderite, scheelite, and ferberite, chromite, cyanite, beryl, pyrolusite and psilomelane, and spodumene have yielded concentrates.

In the field of nonmetallic minerals a comprehensive study was made of domestic iron-oxide mineral pigments occurring in various parts of the United States, with the object of finding suitable sources of pigments to replace French ocher, Italian sienna and Turkish umber. Various domestic pigments of commercial value were found.

As the result of work on the recovery of fine phosphate ores in the land-pebble deposits of Florida, where losses have approximated 50 per cent. of the phosphate in the ore, waste has been greatly curtailed through the introduction of better methods. At three plants, the yearly phosphate recovery has been increased by 81,000 tons.

Chemical engineering studies of polyhalite, the principal potash-bearing salt found in the governmental exploration program in Texas and New Mexico have developed various processes for the recovery of potash from this mineral.

As a means of disseminating information regarding safety and efficiency in the mineral industries the bureau maintains what is perhaps the largest library of educational motion-picture films in the world. During the past year five new films were added to the library.

The most outstanding need of the Bureau, says Director Turner, is the new experiment station at the University of Maryland, College Park, Md., authorized last year. This will provide laboratory facilities readily accessible to headquarters, and enable technicians, now serving only as administrators, also to function as research leaders. The southeastern states will thus be provided with an experiment station for use in developing their non-metallic-mineral resources.

Cement Mill Kept in Step with Progress Through 39 Years of Operation



Plant office, cement-storage silos and packhouse. Part of coal-mill and kiln buildings in background.

Glens Falls Plant, Constantly Modernized, Produces a Quality Product with Economy

THE prevailing slackened business conditions, in the cement industry as well as in most other industries, have impressed upon cement-plant operators the fact that it is not necessary to build an entirely new plant to produce a high-grade product economically. Expenditures on cement plants during the past few years have been devoted almost entirely to the improvement or rebuilding of existing plants. Many of these compare favorably in efficiency and economy, as well as in quality of product, with the best of the new plants. Take, for example, the plant of the Glens Falls Portland Cement Co., at Glens Falls, N. Y., one of the oldest existing cement plants in this country. This has been periodically improved throughout the years and, as a result, has kept pace with the best of the new cement plants.

The history of this cement plant, which is the oldest plant now operating in the state of New York, dates back to the early days of the Portland-cement industry. The plant was originally built in 1893 as the result of an agreement between a number of lime manufacturers, and its purpose was to furnish an economical means of disposal of a layer of argillaceous limestone overlying the stone suited for lime-making. It was not long, however, before the cement plant became the more important of the two and the lime plant was discontinued.

The original cement plant used Hoffman dome-type kilns. These were soon replaced by Schoffer vertical shaft kilns. In 1899 a fire razed the kiln building, but this was immediately rebuilt and the same kilns were used until 1905. At that time the advent of the rotary kiln and the high labor cost

of the vertical kilns resulted in their replacement by rotary kilns during the period from 1905 to 1907. Two of the four old 120-ft. kilns installed at that time are in place and can still be used if necessary.

At that time many other plant improvements were made. New machinery was installed in the raw—and clinker-grinding departments and a coal-grinding mill was built. In 1922 a new storage building for raw materials and clinker was erected. In 1924 it was decided to convert the plant to the wet process to keep pace with the trend in the cement industry. The buildings and some of the machinery then in use and considerable new machinery were used in this reconstruction, which resulted in a wet-process plant with a capacity of 4,000 bbl. per day. As the result of engineering skill and of coöperation between the consulting engineers and the plant operators the conversion was effected without any loss of production. The conversion included the installation of two new 250-ft. kilns.

This plant produced a high grade of standard Portland cement with high-early-strength properties which ultimately decided the company to enter the manufacture of Velo cement in addition to its regular product. At that time Velo cement, a high-early-strength Portland cement developed and patented by F. L. Smidth & Co., had already been manufactured in Europe for several years but no installation of this process had yet been made in this country. This product was first manufactured in November, 1927, without changing the plant equipment. Various factors involved in the manufacture of Velo, however, resulted in decreased capacity when making this cement, so additional



Looking down on coal mill and new kiln building.



Another view of new kiln building and stack.

equipment was installed to keep the plant capacity at 4,000 bbl. per day when making Velo cement.

The next improvement was the construction of a concrete-silo cement-storage unit to supplement the original stock-houses. No other important changes were then made until September, 1931, when a new and improved Unax kiln 382 ft. in length was installed in place of the 120-ft. units. This kiln is without question far in advance of conventional kiln design and has the F. L. S. Centralized electrical-control system which takes into account every factor entering into kiln operation and guards against any contingencies which might arise. This kiln was not installed to increase the capacity of the plant but to replace the four 120-ft. kilns which were installed in 1905. The 100-bbl. per hr. capacity of this kiln is greater than that of the four old kilns combined and it is much more economical to operate. The plant capacity with three kilns is now 4,000 bbl. per day. Two of the 120-ft. kilns were taken out to make room for the new unit, but the other two remain in place and can be used in an emergency. Both these were kept going until the new unit went into operation.

The deposit which furnishes the raw material for the plant is part of the Trenton limestone. It consists of layers of argillaceous limestone with a lime content of from 65 to 96 per cent. The quarry is



Another view of storage silos and packhouse with barge canal in foreground.

being worked in two levels, the stone with low-lime content on the top level forming the bulk of the stone used, while the high-lime stone from the lower level is used in sufficient quantities roughly to approximate the desired mix.

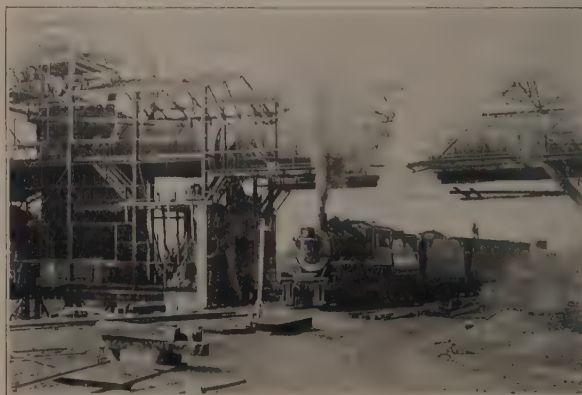
The deposit has an overburden of soil and clay averaging about 3 ft. in depth. This is removed as needed by a scraper operated from the drum of a small tractor. All drilling is done with two 6-in. electric well-drills, one of Armstrong and one of



Loading stone on the upper level in quarry.

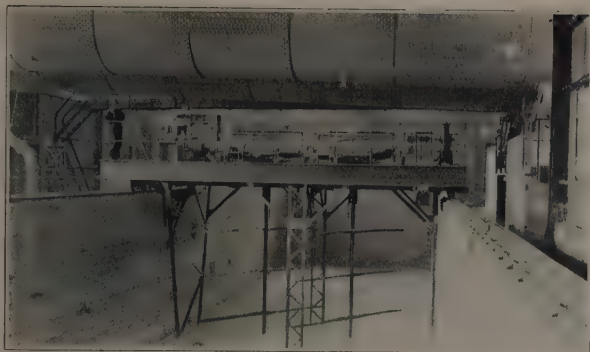
Keystone manufacture. Because of the proximity of residential districts no large shots are made. Usually 5-hole single-row shots, using DuPont 40- and 60-per cent. dynamites and Cordeau-Bickford safety fuse are made. Secondary drilling is done with Ingersoll-Rand Jackhammers. The upper level has a 100-ft. face and the lower level a 30-ft. face.

The low-lime stone on the upper level is loaded by two Type 37 Marion electric shovels with $1\frac{3}{4}$ -cu. yd. dippers into 6-ton Western side-dump cars. These are hauled to the quarry incline in trains of 6



Construction view showing kiln extending over railroad.

cars by Vulcan 20-ton gasoline locomotives. These two shovels are so placed that each can load three cars of each train at one time, thus reducing the waiting time of the locomotives. The high-lime stone on the lower level is loaded by a third Type 37 Marion electric shovel into trains of three Western 6-cu.yd. cars hauled by Vulcan 20-ton gasoline locomotives.



The traveling slurry agitator under two of the kilns.

The loaded cars are hauled one at a time by hoist and cable up a single-track incline to the crushing plant on the edge of the quarry. Primary crushing is done by an Allis-Chalmers No. 9 McCully gyratory crusher, which feeds by belt-conveyor to a Williams Jumbo hammer-mill for further reduction to 2½ in. and under. An elevator feeds to the storage-bins. The finished stone is hauled a distance of about 1,500 ft. to the cement plant in a train of nine 6-ton end-dump cars by a Vulcan 25-ton steam locomotive. An Ingersoll-Rand Imperial Type XCB 9¼-in. by 15-in. by 12-in. air-compressor at the crushing plant furnishes air for the quarry operations.

The cars of stone are dumped at the plant by means of a hoist and tippie into a corner of the raw-



Drive of one of the finish-grinding tube mills.

material storage-building. An electric overhead crane distributes the stone to the storage, which has a capacity of 15,000 tons, or rehandles the high- or low-limestone as required to a feed-box in the raw-mill building. A pivoted-bucket conveyor then feeds the material to the individual feed-bins of the four No. 85 Kominuters used for raw grinding. Enough water is now added to give the mixture a moisture content of approximately 35 per cent. The resulting slurry is fed to four No. 10 Trix separators, the "coarse" from which goes in closed-circuit back through the Kominuters and the "fines" to the three tube-mills.

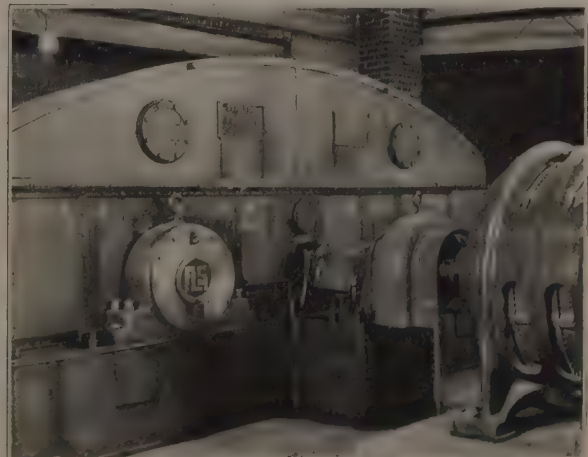
These are No. 18 Smidth mills and grind the slurry to a fineness of 90 per cent. through 200-mesh. The slurry is then delivered by two Wilfley pumps to a series of six correcting tanks, which have a capacity of 480 bbl. each. These discharge by gravity to a large concrete mixing basin with a quadruple agitator and a capacity of 1,665 bbl. The corrected slurry is conveyed by air-lift pumps to an open storage-tank under the kilns. This tank is 25 ft. wide, 125 ft. long and 21 ft. deep and has a capacity equivalent to 7,200 bbl. of clinker. It is equipped with a Smidth traveling agitator employing two paddles and air to keep the slurry from segregating. This is the first agitator of this type in the cement industry. Slurry is fed from this



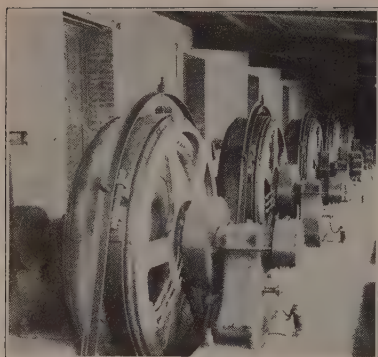
Drive of quadruple slurry agitator over mixing basin.

tank to the kiln-feeders by a battery of plunger pumps. The feed device on each of the kilns except the new one consists of a tank, the contents of which are kept at a constant level by an overflow, and which supplies the kiln through a valve and spout that control the rate of feed.

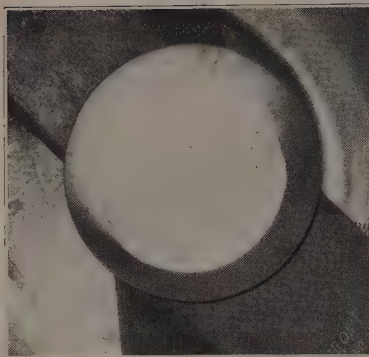
The slurry-correcting tanks were originally three in number. When the plant was enlarged a fourth was added to these three and two others were installed near. All have mechanical and air agitators, all those in the unit of four being driven by the same 25-h.p. motor through a Jones speed-reducer. The agitators on the other two correcting tanks are



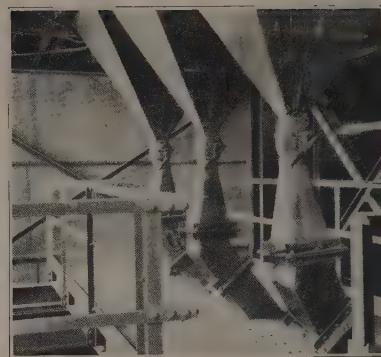
The inclosed-gear-reducer drive of one of the new grinding mills.



Motors driving the five finish-grinding tube-mills.



Multiple-gas-discharge port at feed end of new kiln.



Discharge of three-section dust collector in the packing building.

driven by a 15-hp. motor through a Jones speed-reducer. The quadruple agitator over the large mixing tank is driven by a 25-hp. motor through a Jones speed-reducer. The Kominuters, Trix separators, and tube-mills are driven by 125-hp., 10-hp., and 300-hp. motors, respectively.

The slurry is fed to the new kiln by a Smidth feeder of the adjustable spiral-scoop type, which is driven by an Electro-Dynamic Co. inter-pole motor of special speed characteristics through a Falk coupling and Link-Belt silent-chain drive. A revolution counter on the feeder-shaft allows checking of the feed at this point, and a paddle arrangement in the feeder-discharge pipe, turned by the slurry, flashes a light on the kiln-control board which shows whether or not slurry is being fed to the kiln. The rate of feed can be varied about 15 per cent. by the burner. Wider variations in the feed are controlled by means of a hand-wheel, which can be reset only by the chief chemist. Other than this, the rate of of feed varies only in proportion to the speed of the kiln.

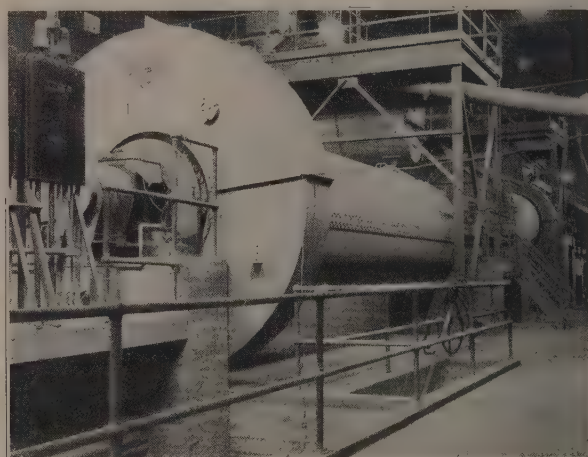


The three-compartment water-cooled finish-grinding mill.

The kiln is the latest improved Smidth Unax type with an unusually complete system of control. It is 382 ft. long and is 10 ft. 8 in. and 9 ft. 8 in. in diameter. The discharge end has a Unax clinker-cooling system consisting of 10 cylindrical coolers,

each 4 ft. 6 in. in diameter and 18 ft. long. The kiln shell is supported on six tires riding on single roller-bearing rolls. All these tires are of the floating type, except the one nearest the drive gear which takes up any thrust. Should anything cause the kiln travel to vary unduly from its usual path an electrical safety device immediately stops it. The tire-rolls run in a bath of water with a thin film of oil on top to insure adequate lubrication.

The kiln drive-gear is supported on flexible-steel



One of the two tube-mills used for grinding Velo cement. Second mill in background.

spring-plates to take up diametrical kiln expansion and has cut-teeth gears to insure smoothness and quietness in operation. The kiln is driven by a 25/75-hp. d.-c. motor through a Falk speed-reducer. An inter-pole generator on the motor shaft furnishes current for an inter-pole motor on the slurry-feed drive, varying the slurry feed to the kiln in direct proportion to the speed of the kiln. When power is shut off from the kiln motor, an automatic band-brake stops the kiln and prevents rocking. The kiln can be run at any speed from 40 sec. to 2 min. per revolution. Actually only about 45 hp. is required to run the kiln, which weighs about 1,000 tons loaded. It is so accurately balanced that one man can turn it with a 16-in. wrench applied on the high-speed shaft of the reducer.

The kiln is pulverized-coal-fired in the usual man-

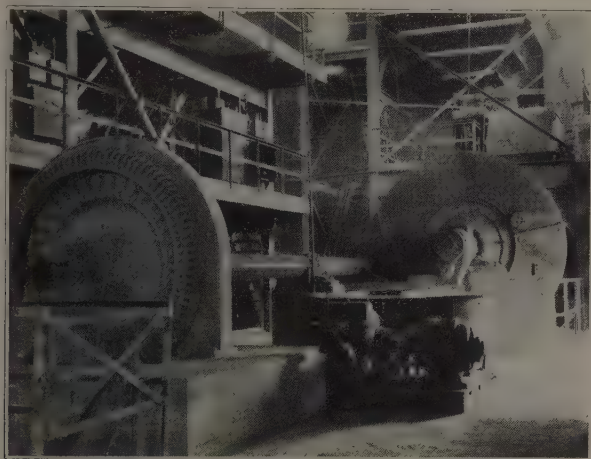
ner with coal from the same grinding plant which supplies the other kilns. The kiln can be operated at low capacity with natural draft from the kiln stack if necessary, but is most efficient when using induced draft from a F.L.S. fan at its feed end. This fan is driven by a 60-hp. motor through a Link-Belt silent-chain drive and is protected by a thermostat which blows a horn on the burner platform when the temperature rises above 600 deg. F. A Smidth pilot motor-controlled *louvre* damper at the feed end of the kiln controls the draft. Control buttons and an electrical position-indicator for this damper are located on the kiln-control panel on the burner platform. Two extra discharge points for the exhaust gases from the kiln allow the use of baffles of more than ordinary size at its feed end, thereby eliminating any possibility of slurry overflow at that point.

Special high-alumina-brick lining is used in the burning zone of the kiln. A Smidth chain system,

but also a number of others not ordinarily found. All motor-control push-button switches are grouped separately for each part of the operation—coal-feed, slurry-feed, kiln-drive, etc.—together with speed controls for each unit. Among the instruments on this board are a *louvre* damper position-indicator; kiln and slurry-feeder magnetic revolution-counters,



Two of the 250-ft. kilns not replaced by the new unit.



Single-tank slurry agitator, tube-mill and drive and one of the ball-mills in the finish-mill building.

a kiln-temperature indicator; two pointer gauges showing the air draft at both ends of the kiln, and two meters showing the CO_2 and $\text{CO} + \text{H}_2$ content of the exhaust gases. The indication of these two meters and the gas temperatures are recorded on charts in the plant superintendent's office.

The engineers' design of this part of the combustion-control utilizes Bacharach instruments for the continual analyses, by electrical means of the $\text{CO} + \text{H}_2$ and CO_2 content of the gases to give the most efficient and economical kiln operation. It is well known that these gases are always in direct relationship to each other—when one is high the other is low. In most kilns a CO_2 content of about 28 per cent. gives the best results, and a deviation in either direction results in higher fuel consumption and less efficient burning. As a result of this close control this kiln is producing 100 bbl. of cement per hr. with a coal consumption of less than 85 lb. (railroad weight) per bbl. As the coal used contains 13,250 B.t.u. per lb., this gives a fuel consumption approaching 1,000,000 B.t.u. per bbl.

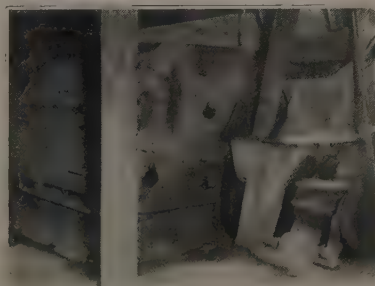
The two 250-ft. kilns occupied all the space available at the time of their installation, as their stacks

suspended inside the feed end of the kiln, contributes to the fuel economy of the kiln. Similar strands of chain in the clinker coolers break up the clinker to give more rapid cooling. The efficiency of the cooling system is evident from the fact that the temperature of the clinker when entering the cooler is 2,250 deg. F. and when leaving the cooler about 410 deg. F.

The kiln has an F.L.S. centralized kiln-control-board on its burner platform, which not only has the usual push-button switches, meters and gauges



One of the two units which feed cement from storage silos.

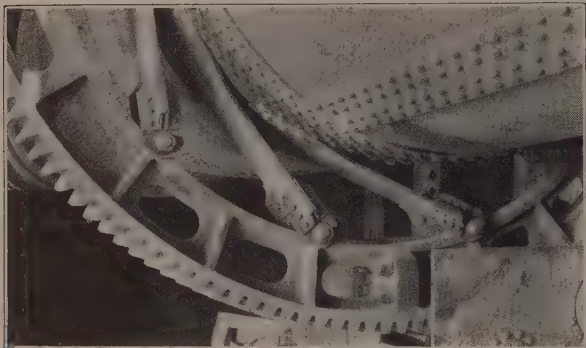


One of the four raw-grinding ball-mills.



The louvre-damper control between draft fan and dust chamber.

were almost on the right-of-way of a branch of the Delaware & Hudson Ry., which serves the plant and separates it from the quarry. Expansion in the other direction was impracticable, so an agreement was reached with the railroad to bridge its tracks. The foundations for the feed end of the kiln and the stack were placed in an old quarry across the tracks from the plant, and the kiln and its housing were built across it, leaving ample clearance over the tracks. The kiln and the slurry-feed house are inclosed with structural steel and Robertson protected metal. The new kiln stack alongside the slurry-feed house was built by the Rust Engineering Co. It is 275 ft. 6 in. in height and the inside diameter of its brick lining is 8 ft. The lining is

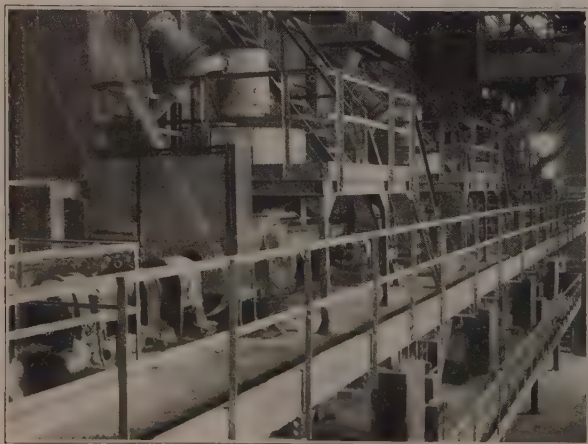


View illustrating spring-plate method of holding master gear to kiln shell.

separate from the stack, leaving an air space between them with air vents through the concrete for ventilation.

The two kilns installed in 1924 also have some noteworthy features. They are 9-ft. by 10-ft. by 250-ft. units, each driven by a slip-ring 75-hp. motor. These are designed so that their discharge sections serve as coolers for the clinker and, at the same time, pre-heat the air for combustion. Smidth patented chain systems were installed in these kilns two years ago and among other benefits derived was a decrease of 8 per cent. in fuel consumption.

The clinker from all the kilns is discharged to a McCaslin conveyor, which feeds two 7-ft. by 60-ft. rotary coolers. These discharge to the clinker-stor-



The preliminary raw-grinding mill with separators below.



Speed-reducer drive of new kiln with interpole generator which regulates slurry feed.

age section of the storage building which has a capacity of 60,000 bbl. The same electric overhead crane used for the raw materials distributes the clinker in this storage and later rehandles it to the finish-mill feed-bins.

Preliminary grinding is done by six No. 66 Kominuters, which discharge to five No. 18 Smidth tube-mills. Gypsum in the proper proportion is added at this point by rocker feeders. These are supplemented by a 3-compartment 7-ft. by 39-ft. Smidth Unidan mill, two compartments containing balls and a third,



Coal screw-feeder and blower for new kiln.

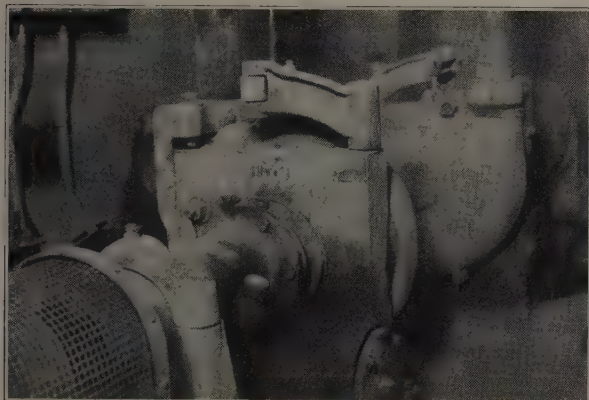
which is water-cooled, containing Cylpebs. The Kominuters and tube-mills are driven by 75-hp. and 300-hp. synchronous motors, respectively, and the Unidan mill is driven by a 550-hp. motor through a Smidth Symetro trunnion drive. The tube- and Unidan-mill motors are in a room separate from the mill-room, their drive shafts extending through the intervening wall. A Box 5-ton overhead hoist in the motor-room handles repairs and parts. Two dust-arrestors keep this department clean.

The finished cement is fed from the tube- and Unidan mills in the finish-grinding department to a series of screw-conveyors and elevators to the top of the storage silos or to any of four store-houses.

The latter have a total capacity of 400,000 bbl. The silo storage-unit consists of 6 silos, each 40 ft. in diameter and 60 ft. high, which, together with the 2 interstitial and 6 exterior pockets, have a capacity of 130,000 bbl. The cement is recovered from the silos through two rows of gates in each of four tunnels. Two Smidth Exbiners, each taking care of two tunnels, feed from these gates to four screw-conveyors extending the length of the silos. Each of these is driven by a 10-hp. motor through a Jones speed-reducer. The screw-conveyors feed a cross screw-conveyor, from which the cement passes by an elevator to a rotary screen over the packer bins in the packing building. These feed to two 3-bag Bates packers, which have spill screws forming a



Two of the packers and bins in the new packhouse.



Two of the centrifugal slurry pumps.

closed-circuit. A 3-unit Sly dust-arrestor keeps this building clean.

Shipments are made by railway, road, or water. Rail shipments are made over the Delaware & Hartford Ry. which runs by the plant and which connects with other lines for distribution in any direction. Barge shipments were at one time one of the chief methods of distribution and some cement is still shipped in this manner. The plant is located on Glens Falls Canal which leads to Fort Edward, N. Y., where it joins Champlain Canal from Canada to Waterford, N. Y., at which point this, in turn, joins Erie Canal to Hudson River. Truck shipments have increased rapidly in the last few years and this is now an important means of distribution. A

weigh-house was recently installed near the storage silos and storehouses to weigh bulk truck shipments. A Howe scale and Weightograph are used.

Coal is discharged from bottom-dump cars on a siding at the plant to a hopper feeding a skip-hoist, which discharges to a concrete storage-silo of 300-ton capacity. A spout allows the coal to be discharged to a pile outside the silo, and there it is distributed to a stock-pile by a Beaumont drag-scraper. This is operated from a tower and has a number of tail-posts which give the system a stock-piling capacity of about 15,000 tons. The scraper also recovers the coal from the stock-pile to the skip-hoist feeding back into the silo from which it is fed to the coal-mill.

Grinding and drying are done in two Smidth Pyratons. These are two-compartment mills with a system for separately heating the steel balls which dry the coal and do the preliminary grinding. Final grinding of the coal is done in the second compartments and a Fuller-Kinyon pump conveys the ground coal to the kiln feed-bins.

Beginning with the installation of the first rotary kilns in this plant in 1905, all changes in the plant were made under the supervision of F. L. Smidth & Co., engineers, and most of the equipment was furnished by them. This includes the Kominuters, Trix separators, tube-mills, kilns, slurry agitators, slurry air-lift pumps, coolers, and many other items. The two 250-ft. kilns are of Reeves make and the two 250-ft. concrete stacks for these were built by the General Concrete Construction Co. General Electric motors are used throughout the plant and all slurry lines are equipped with Merco-Nordstrom valves.

The main office of the company at 205 Lower Warren St., Glens Falls, is located in a concrete-and-stucco building on the property. The basement of this building houses the chemical and testing laboratories, which are completely equipped to make any required tests or analyses. George F. Bayle is president and general manager; George F. Bayle, Jr., vice-president; Frank W. Wait, secretary; and Robert C. Carter, treasurer. F. P. Monaghan is plant superintendent and J. B. Dixon chief chemist.



Trainload of stone being discharged to primary-crushing plant.

Portland Cement Association Reviews a Year of Accident Prevention

Forty-three Mills Operated During 1931 Without Suffering a Lost-Time Accident

By STANLEY OWENS
Safety Engineer, Portland Cement Assn.

BREAKING all previously established low records for accidents to employees in the mills and quarries of its member companies, the Portland Cement Assn., announces that the 1931 accident-prevention endeavors have resulted in a lowering of the total number of lost-time and fatal accidents suffered in all of its member mills by approximately 50 per cent. The lowest previous record was established in 1930 during which year the cement industry, as represented by the membership of the association, was credited by the National Safety Council with having the lowest accident-frequency rating of all American industries.

A compilation of telegrams and cables arriving at the association offices on January 2 shows that a total of 43 member plants completed the 1931 operating season without a lost-time or fatal accident. Thirty-seven of these plants are entitled to the annual safety trophy award of the Association. The remaining 6 plants did not burn clinker for an aggregate of six months throughout the operating year and, consequently, were not eligible for the award according to the rules of the contest.

"The record of 43 plants and quarries safely operating through 1931 without a lost-time or fatal accident is most remarkable," said W. M. Kinney, general manager, of the Association, "in view of the fact that there were 16 less plants operating in 1931 than in the previous year when there was a total of 46 plants with a perfect record."

Nineteen of the 1931 trophy winning plants have already received the award for successful records in past years. Each of these plants will have the new record inscribed on the massive base of its trophy which will then be re-dedicated with appropriate ceremonies. The Association will award 18 new trophies to plants which have not as yet won the award. Some of these plants had already selected a location for their monument, and landscaped the site as a psychological inducement to the employees to win the trophy.

There was a total of 26 other plants which operated the 1931 season with but one lost time or fatal accident each. Sixteen fatalities were suffered in member plants during 1931 against 18 in the previous year. This compares favorably with former years; for example 1924, in which year there were 76 employees fatally injured. There was a total of 437 lost time, including fatal accidents, suffered in 1930 as against 225 in 1931, a reduction of almost 50 per cent. The man-hour figures are not available at this time for use in calculating the accident frequency, but it is expected that the percentage of decline in man-hours necessitated by depressed business conditions during 1931 will be considerably less than the percentage of reduction in accidents. It is anticipated, therefore, that the accident-frequency rating of the cement industry, as represented by the membership of the Portland Cement Assn., will show a material reduction in 1931 over that of the record low figure established in the previous year.

The accompanying table shows the trophy winning plants listed in order of the number of days clear to January 1, 1932. An examination of this table shows that the Lehigh plant at Iola, Kan., and the Alpha plant at Ironton, O., have each operated over five consecutive years without a lost time or fatal accident. This represents the most remarkable safety record that has ever been established in the cement industry.

The Northampton mill of the Universal Atlas Cement Co., which includes plants No. 2, No. 3 and No. 4, under Superintendent M. W. Winsch, is the largest producing unit ever to win the association trophy.

The Lehigh Portland Cement Co. had the largest number of individual plants on the trophy award list with six plants and quarries showing perfect records. This was followed by the Alpha and Universal Atlas companies, each of which contributed 3 plants. The Canada Cement Co., Ltd., Medusa



MEMBERS OF THE NEWLY-CREATED 1,000-DAY CLUB

Operating heads of seven cement plants which have had no accidents for 1,000 days or more. *Left to right*—C. A. Swiggett, Iola, Kan., plant, Lehigh; William J. Montz, Ormrod, Pa., plants, Lehigh; J. H. Colton, Redwood City plant, Pacific; R. H. MacFetridge, Birmingham, Ala., plant, Lehigh; W. J. Worthy, Toledo, O., plant, Medusa; F. C. Brownstead, Ironton, O., plant, Alpha; A. T. BeVier, Buffalo, N. Y., plant, Great Lakes.

Position	Company	Plant	Superintendent	Date of Last Disqualifying Accident	Days Clear to Jan. 1, 1932
1	*Lehigh	Iola, Kan.	C. A. Swiggett	Sept. 9, 1926	1939
2	*Alpha	Ironton, O.	F. C. Brownstead	Dec. 8, 1926	1849
3	*Medusa	Toledo, O.	W. J. Worthy	Apr. 5, 1928	1365
4	*Lehigh	Ormdod, Pa., No. 2	Wm. J. Montz	July 25, 1928	1254
5	*Lehigh	Birmingham, Ala.	R. H. MacFetridge	Aug. 25, 1928	1223
6	*Pacine	Redwood City, Calif.	A. G. Lang	Nov. 27, 1928	1129
7	*Great Lakes	Buffalo, N. Y.	A. T. BeVier	Dec. 29, 1928	1107
8	*Nazareth	Nazareth, Pa.	H. A. Reichenbach	Apr. 16, 1929	989
9	*Alpha	Cementon, N. Y.	Arch Brown	June 24, 1929	920
10	*North American	Howes Cave, N. Y.	J. W. Campbell	Aug. 17, 1929	866
11	*Manitowoc	Manitowoc, Wis.	F. E. Town	Oct. 2, 1929	820
12	*Canada	Exshaw, Alta.	W. D. Armstrong	Dec. 5, 1929	756
13	*San Antonio	San Antonio, Tex.	H. O. Rinehold	Dec. 10, 1929	751
14	*Trinity	Fort Worth, Tex.	A. A. Chaney	Dec. 12, 1929	749
15	*Cuban	Cayo Mason, Cuba	John Rae	Dec. 19, 1929	742
16	*Lone Star Ala.	Spocari, Ala.	W. W. Deadman	Jan. 11, 1930	719
17	*Superior	Concrete, Wash.	H. A. Ambler	Jan. 23, 1930	707
18	*Hercules	Nazareth, Pa.	J. Stanley Downs	Feb. 10, 1930	689
19	*Lone Star Ala.	Birmingham, Ala.	W. M. Cabaniss	Mar. 2, 1930	669
20	*Santa Cruz	Davenport, Cal.	Fred Davis	Apr. 14, 1930	626
21	*Canada	Lakefield, Ont.	E. W. Bailey	May 24, 1930	586
22	*Yosemite	Merced, Cal.	A. P. DeJonckheers	June 12, 1930	567
23	*Calaveras	San Andreas, Cal.	R. H. Townsend	June 30, 1930	549
24	*Pitts. Pl. Glass	Fultonham, Ohio	Robt. W. McAllister	July 7, 1930	542
25	*Lehigh	Ormdod, Pa., No. 3	Wm. J. Montz	July 15, 1930	534
26	*Ash Grove	Louisville, Neb.	A. K. Frolich	Aug. 16, 1930	502
27	*Lehigh	Oglesby, Ill.	John Young	Sept. 20, 1930	467
28	*Southwestern	Osborn, Ohio	W. T. Groner	Oct. 2, 1930	455
29	*Glens Falls	Glens Falls, N. Y.	F. P. Monaghan	Nov. 20, 1930	406
30	*Southwestern	El Paso, Tex.	H. E. Nichols	Nov. 24, 1930	402
31	*Lawrence	Thomaston, Me.	A. L. Wolf	Dec. 1, 1930	395
32	*Olympic	Bellingham, Wash.	A. F. Krabbe	Dec. 9, 1930	387
33	*Penn. Dixie	Valley Junction, Ia.	R. A. Bechtold	Dec. 16, 1930	380
34	*Univ. Atlas	Leeds, Ala.	B. E. Merrell	Dec. 17, 1930	379
35	*Univ. Atlas	Northampton, Pa.	M. W. Winsch	Dec. 17, 1930	379
36	*Lehigh	Metaline Falls, Wash.	H. Helwig	Dec. 27, 1930	369
37	*Univ. Atlas	Independence, Kan.	C. M. Carman	Dec. 30, 1930	366

Member Plants with Perfect Records but Ineligible for 1931 Trophy because of not having burned Clinker for an Aggregate of 6 Months

1	*Canada	Ft. Whyte, Man.	V. C. Hamilton	Nov. 28, 1929	1128
2	*Newaygo	Newaygo, Mich.	L. E. Smith	Dec. 11, 1929	1115
3	*Medusa	York, Pa. (White)	R. J. Landis	Sept. 12, 1929	840
4	*Medusa	Bay Bridge, O.	A. J. Little	Nov. 1, 1929	790
5	*Cowell	Cowell, Calif.	E. D. Barnett	Nov. 22, 1930	769
6	*Alpha	Jamesville, N. Y.	E. L. Boyne	June 23, 1930	556

*Previous trophy winner.

Portland Cement Co., and the Southwestern Portland Cement Co. each furnished two plants to the trophy list.

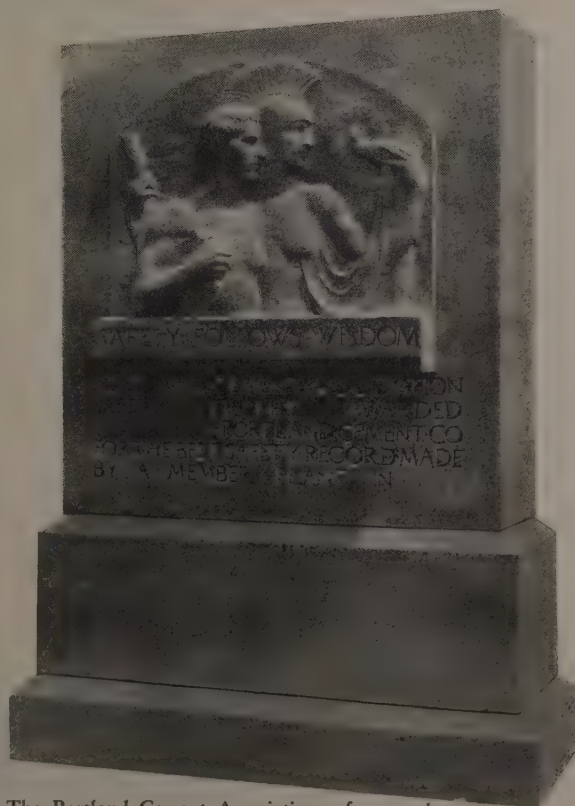
The largest group of trophies ever sent to the west coast will be shipped this year when the awards are made to Superior Portland Cement, Inc., at Concrete, Wash.; Santa Cruz Portland Cement Co. at Davenport, Cal.; the Yosemite Portland Cement Co. at Merced, Cal.; the Calaveras Cement Co. at San Andreas, Cal.; the Olympic Portland Cement Co. at Bellingham, Wash., and the Lehigh Portland Cement Co. at Metaline Falls, Wash. Orders for these trophies will be placed shortly in order that they will have the proper time to set before taking the long overland journey to their final destination.

The state of Pennsylvania lays claim to the largest number of 1931 trophy winning plants, there being five in that state to be awarded the trophy. California, Ohio and New York are next, each having four plants

which won the award in 1931.

Since the association's spring meeting, exercises in connection with the dedication or re-dedication of association trophies were held at 41 mills. Among speakers and guests of prominence on these occasions were two governors, several senators and congressmen, many members of state legislatures, mayors and leading industrialists. From a public, as well as an employee relations standpoint, the 1930 contest proved valuable.

The June No-Accident contest was again successfully conducted in 1931, establishing a new low record for this 30-day period so far as frequency is concerned, although from the standpoint of severity the results were disappointing. With 135 mills enrolled a total of 10 lost-time accidents and 3 fatalities were reported from 12 plants. One mill suffered two lost-time accidents, 3 mills suffered one fatal accident each, and 8 mills had one lost-time accident each. This



The Portland Cement Association safety trophy.

(Continued on page 89)

Sand-and-Gravel Producers Reorganize Missouri Valley Association

By CARL M. HISE

Executive Secretary, Missouri Valley Sand and Gravel Association

THIRTY-NINE sand-and-gravel producers from Kansas, Missouri, and Oklahoma met at the Kansas City Athletic Club, December 10 and 11, 1931, and reorganized the Missouri Valley Sand and Gravel Assn. The association is one of the oldest district organizations in the sand-and-gravel industry, having been in operation some twelve years. In the last few years, however, it has been more or less in an inactive state, due to the fact that its members were devoting most of their time to their several state associations. Fully realizing that our troubles and difficulties must be met within our own ranks, for no help could be expected from the outside, it was the opinion of all present that, if a combined effort be used, a better and quicker result could be accomplished, both to ourselves and the public at large. Hence, the combining of these state associations under the one head. The association elected the following officers for the year 1932:

Otto Kuehne, Jr., Kansas Sand Co., Topeka, Kan., chairman; Frank W. Peck, Peck-Thompson Sand & Material Co., Kansas City, Mo., vice-chairman; John Prince, Stewart Sand & Material Co., Kansas City, Mo., treasurer; Carl M. Hise, Kansas City, Mo., executive secretary.

The Western Missouri Sand-Gravel Assn., an association within the Missouri Valley Sand & Gravel Assn., also held a meeting and elected the following officers for the year 1932:

Frank W. Peck, Peck-Thompson Sand & Material Company, Kansas City, Mo., president; R. J. Stewart, Pioneer Sand Company, St. Joseph, Mo., vice-president; John Prince, Sand & Material Company, Kansas City, Mo., treasurer; Carl M. Hise, Kansas City, Mo., executive secretary.

The Western Missouri association has at the present time, eleven active members all operating plants in the western part of Missouri.

The Sunflower Sand-Gravel Assn., the Kansas branch of the Missouri Valley Sand & Gravel Assn., held its first annual meeting and elected the following officers for 1932:

Otto Kuehne, Jr., Kansas Sand Company, Topeka, Kans., president; E. B. Winkler, Lawson Sand & Material Co., Kansas City, Mo., vice-president; T. P. Russell, Southwest Sand & Gravel Co., Dodge City, Kan., treasurer; Carl M. Hise, Kansas City, Mo., executive, secretary.

The Sunflower association has a membership at the present time of twenty-two, all operating plants in the state of Kansas. This association has been active all year, and several very instructive talks were made during the two days on the direct accomplishments made for the producers of Kansas, one of the most outstanding being the arrangement of a school for sand-and-gravel producers at the

Kansas State College of Agriculture and Applied Science at Manhattan, Kan., January 11, 12, and 13, inclusive. This program, outlined below, was arranged by Prof. C. H. Scholer, construction-material engineer of the school, and H. Allen, material engineer of the highway department. It is needless to say that the results of such a program will be far reaching to the sand-and-gravel producers of Kansas and to the state highway department as well.

January 11

Morning—Registration.

Afternoon—"Standard Physical Properties," by W. E. Gibson. Discussion.

Evening—Inspection of Laboratories.

January 12

Morning—"Preliminary Tests," by L. H. Koenitzer. Discussion.

"Geology of the Material," by Prof. Sperry. Discussion.

Afternoon—"The Trial Mix," by H. Allen, state highway dept. Discussion.

Evening Dinner—Address by Stanton Walker, Chief Engineer, National Sand & Gravel Assn., Washington, D. C.

January 13

Morning—"Economy of Design," by L. H. Koenitzer. Discussion.

"Sand-Gravel Surfacing," by I. E. Taylor, state highway dept. Discussion.

Afternoon, "Bituminous Mat Surfaces," by F. S. Gilmore, state highway dept. Discussion.

"Sand-Gravel in Bituminous Mats," by L. L. Marsh.

The following producers attended the joint meeting:

O. W. Knight, River Sand Co., Topeka, Kan.
Alva Stryker, Blue River Sand & Gravel Co., Irving, Kan.
Harry Moore, Missouri River Sand & Gravel Co., Boonville, Mo.

Harry Moore, Jr., Missouri River Sand & Gravel Co., Boonville, Mo.

John Prince, Stewart Sand & Material Company, Kansas City, Mo.

Geo. Cook, Stewart Sand & Material Company, Kansas City, Mo.

Geo. Garrett, Stewart Sand & Material Company, Kansas City, Mo.

Wm. Stewart, Stewart Sand & Material Company, Kansas City, Mo.

M. M. Small, Victory Sand & Gravel Co., Topeka, Kan.

Otto Kuehne, Jr., Kansas Sand Co., Topeka, Kan.

A. F. Pierce, Kansas Sand Co., Topeka, Kan.

N. C. Dunn, Arkansas City Sand & Gravel Co., Arkansas City, Kan.

Roy More, More Sand Co., Junction City, Kan.
Walter Kennedy, Welch-Sandler Sand Co., Frisbie, Kan.
Harry Sandler, Welch-Sandler Sand Co., Kansas City, Mo.
Casimer J. Welch, Welch-Sandler Sand Co., Kansas City, Mo.

L. M. Chalmers, DeSoto Kaw River Sand & Gravel Co., DeSoto, Kan.
 R. Tuttle, DeSoto Kaw River Sand & Gravel Co., DeSoto, Kan.
 Bert Fisher, Glasgow Sand Co., Glasgow, Mo.
 E. R. Putnam, Putnam Sand Co., Salina, Kan.
 E. E. Gimmell, Putnam Sand Co., Salina, Kan.
 Frank W. Peck, Peck-Thompson Sand & Material Co., Kansas City, Mo.
 Frank C. Peck, Peck-Thompson Sand & Material Co., Kansas City, Mo.
 Wm. Pirnie, Peck-Thompson Sand & Material Co., Kansas City, Mo.
 R. J. Stewart, Pioneer Sand Co., St. Joseph, Mo.
 E. B. Winkler, Lawson Sand & Material Co., Kansas City, Mo.
 C. C. Shackelsworth, Lawson Sand & Material Co., Kansas City, Mo.
 Frank A. Laughead, Consumers Sand Co., Topeka, Kan.
 Chas. Hoag, Consumers Sand Co., Topeka, Kan.
 F. H. Gades, Lawrence Sand & Gravel Co., Lawrence, Kan.
 F. C. Dresser, Dresser Sand Co., Leavenworth, Kan.
 John Westover, Washington County Sand & Gravel Co., Hanover, Kan.
 C. J. Jackson, Edwin Ahlskog Co., Holliday, Kan.
 Frank Kaul, Blue Rapids Sand & Gravel Co., Blue Rapids, Kan.
 Harry West, West Sand Company, Muskogee, Okla.
 W. E. Seright, Independent Sand & Gravel Company, Wichita, Kan.
 F. P. Morton, Webb City-Joplin Sand & Gravel Company, Mulvane, Kan.
 W. E. Rogers, Arkansas River Sand Company, Tulsa, Okla.
 Carl M. Hise, Kansas City, Mo.

New Batching Plant in Brooklyn Uses Automatic Control

(Continued from page 48)

ture drops 5 deg., the steam is again automatically turned on. Air for the Fuller-Kinyon cement unloader and other purposes is furnished by a Fuller Co. rotary air-compressor with a capacity of 200 cu. ft. per min. This is driven by a 40-hp. Westinghouse induction motor. A National Brake & Electric Mfg. Co. 2-cyl. air-compressor, driven by a 15-hp. General Electric motor, provides air for cement agitation in the bins. The rotary compressor is located in an engine-room near the plant which also houses the boilers for heating the materials.

The concrete plant and its control system were designed by the Stephens-Adamson Mfg. Co. and all the equipment, except that otherwise named, was furnished by them. The control system was furnished by the General Electric Co.

The Cranford Material Corp. is a subsidiary of the Cranford Co., asphalt paving contractor, which company laid the first asphalt pavement in Brooklyn 65 yr. ago. An asphalt plant is maintained on the company's property. Some years ago the company entered into the material business, handling stone, sand, cement, etc. Early in 1931 it was decided to erect the most modern concrete-batching plant that could be purchased and the above-described operation, put in operation a few months ago, was the result.

Forty-Three Cement Plants Had No Accident in 1931

(Continued from page 87)

contrasts with the record of June, 1930, when 129 plants reported 28 accidents, none of which resulted fatally.

Twelve regional safety meetings were held during 1931. The character of papers presented at these meetings showed improvement and there has been considerable demand for reprints from both member companies and trade journals. The attendance at these meetings was greater than in previous years, there being an average of 108 persons present at the 1931 meetings as compared with an average of 99 at the 1930 meetings.

Study Effect of Chert Aggregates on Pits in Concrete Pavements

In a survey of surface pits on concrete pavements, F. V. Reagel, engineer of Materials, Missouri State Highway Dept., explained that its primary purpose was to acquire some information relative to the surface effects of chert as found in Burlington limestone on several concrete pavements constructed with stone having a known chert content. The first survey was made shortly after the pavements had been completed in the autumn of 1926. The second survey was made in the spring of 1927, and the

EFFECT OF CHERT ON PITS IN CONCRETE

Project	Date of Survey	Chert in Aggregate (Per cent.)	Number of Pits	Area Affected by Chert (Sq. yd. per mi.)
1	Autumn, 1926	4.2	1,466	24.52
	Spring, 1927		2,103	35.00
	Spring, 1931		5,673	78.91
	Autumn, 1926	4.3	893	17.57
	Spring, 1927		2,050	36.81
	Spring, 1931		5,346	107.00
3	Autumn, 1926	3.8	493	10.10
	Spring, 1927		2,006	42.11
	Spring, 1931		3,851	75.98
4	Autumn, 1926	4.1	142	5.65
	Spring, 1927		901	30.41
	Spring, 1931		3,029	77.30
5	Autumn, 1926	4.1	67	2.04
	Spring, 1927		872	27.80
	Spring, 1931		2,361	70.84
6	Autumn, 1926	3.4	29	.73
	Spring, 1927		669	24.20
	Spring, 1931		1,793	51.86
7	Autumn, 1926	4.1	480	14.85
	Spring, 1927		592	17.00
	Spring, 1931		1,904	42.85
8	Autumn, 1926	4.0	144	3.20
	Spring, 1927		760	19.82
	Spring, 1931		1,552	36.42
9*	1931	14.0	11,743	376.6

*Pavement 10 years old.

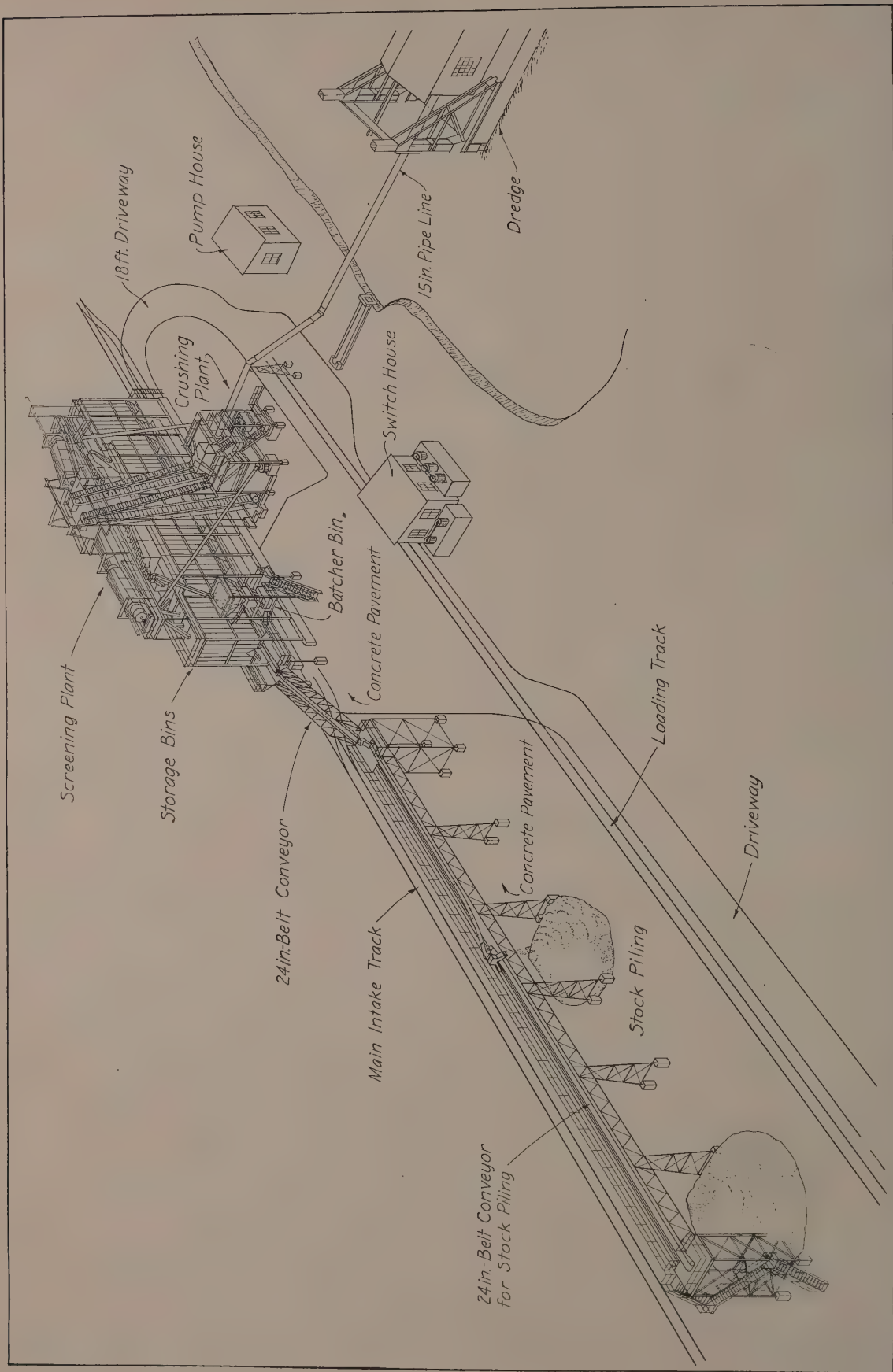
third in the early spring of 1931. A number of the chert pop-outs were measured in order to arrive at the area affected by chert of a certain size. Enough pop-outs in the half-circle state were dug out so that the size of the chert particle could be estimated from the crack in the surface of the pavement. The following is the diameter of the surface area affected by each size of chert particle:

Size of chert particles, 2 in., 1 $\frac{1}{4}$ in., $\frac{3}{4}$ in.

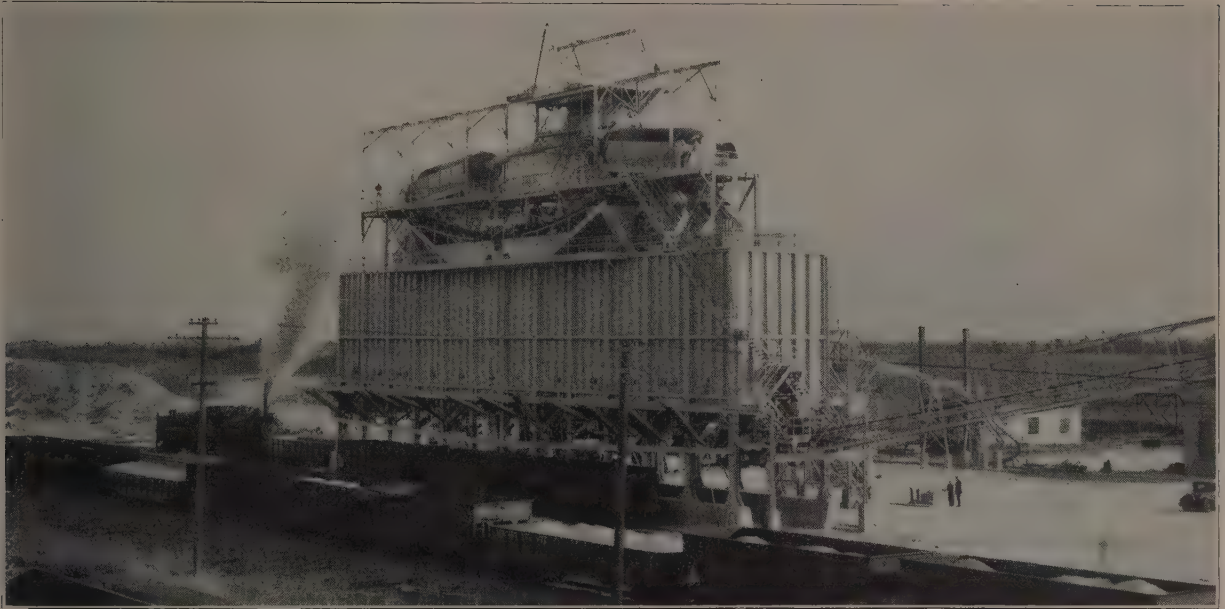
Diameter of surface area affected, 3 $\frac{1}{2}$ in., 2 $\frac{1}{4}$ in., 1 $\frac{1}{4}$ in.

The above table shows the chert content on each project, as well as the total number of pits, and the area affected in square yards per mile for each survey.

The amounts and effects of various other detrimental materials such as sticks, shale, mud balls, lignite, soft stone, etc., were also noted.



Perspective view of new Curtis & Hill Gravel & Sand Co. plant illustrating the compactness and simplicity of the entire operation. The minimum amount of rehandling, proximity of the plant to the dredge pond, ample bins and stock-pile storage capacity, extensive use of concrete pavement and the attractive appearance of the plant are also evident.



The Curtis & Hill plant from the car-loading side showing part of its unusually large car-storage facilities.

New Curtis & Hill Sand-and-Gravel Plant an Outstanding 1931 Development

Advanced Engineering Skill Is Reflected in Dredging Operation near Philadelphia

THE existing conditions in the sand-and-gravel industry have been responsible for the development of many economies in the design and operation of plants which increase their capacities and lower their operating costs without sacrificing quality of product. False economies also are practiced by some producers, who attempt to build new plants using the cheapest of equipment and flimsy construction. Such plants may produce material at low cost for a short time, but sooner or later the upkeep brings costs to a higher level than if modern, permanent plants had been built originally.

The prime requisites for a modern plant of large capacity serving a well-established market are: Simplicity, both in the design and the amount of equipment used; flexibility; and permanence of construction. The new plant of the Curtis & Hill Sand & Gravel Co., near Morrisville, Pa., combines all these features, together with unequaled washing facilities that insure a clean well-graded product. Compactness, permanence and an attractive appearance were also considered important.

The simplicity of this operation is evident from the fact that only 22 power-driven units with a total of 684 installed hp. are used in a plant with a capacity of 400 tons per hr. This includes motors used to drive wash-water pumps and the stock-pile storage-conveyor system. Crushing, screening and bin storage are accomplished by 16 motors with a total

of 440 installed hp. The rehandling of materials is reduced to the minimum.

Because of the depth of the deposit on which the plant was built, compactness was another feature that had to be considered in its design. For this reason bucket-elevators are used to return crushed material to the scalping screens and to feed the screening plant. Considerable space was saved by this arrangement. That none of the deposit is being allowed to go to waste is evident from the nearness of the edge of the dredge pond to the plant.

The third requirement to meet which this plant was built was flexibility. This was accomplished without sacrificing any of the simplicity which was attained through the use of a few operating units of large capacity rather than of a larger number of smaller units. Additional flexibility is given by the duplex plant design. This allows the production of as many as four grades of sand and six sizes of gravel at one time, in addition to two grades of mixed gravel obtained by mixing in the chutes feeding the bins. When desired, the plant can be operated as two separate units, one for road gravel or ballast and the other for concrete gravel. Each unit can also be operated independently in case of a breakdown or when demand is slack. The design also allows the use of a second dredge when additional capacity is desired or when the increased distance of dredging operations from the plant makes it necessary.

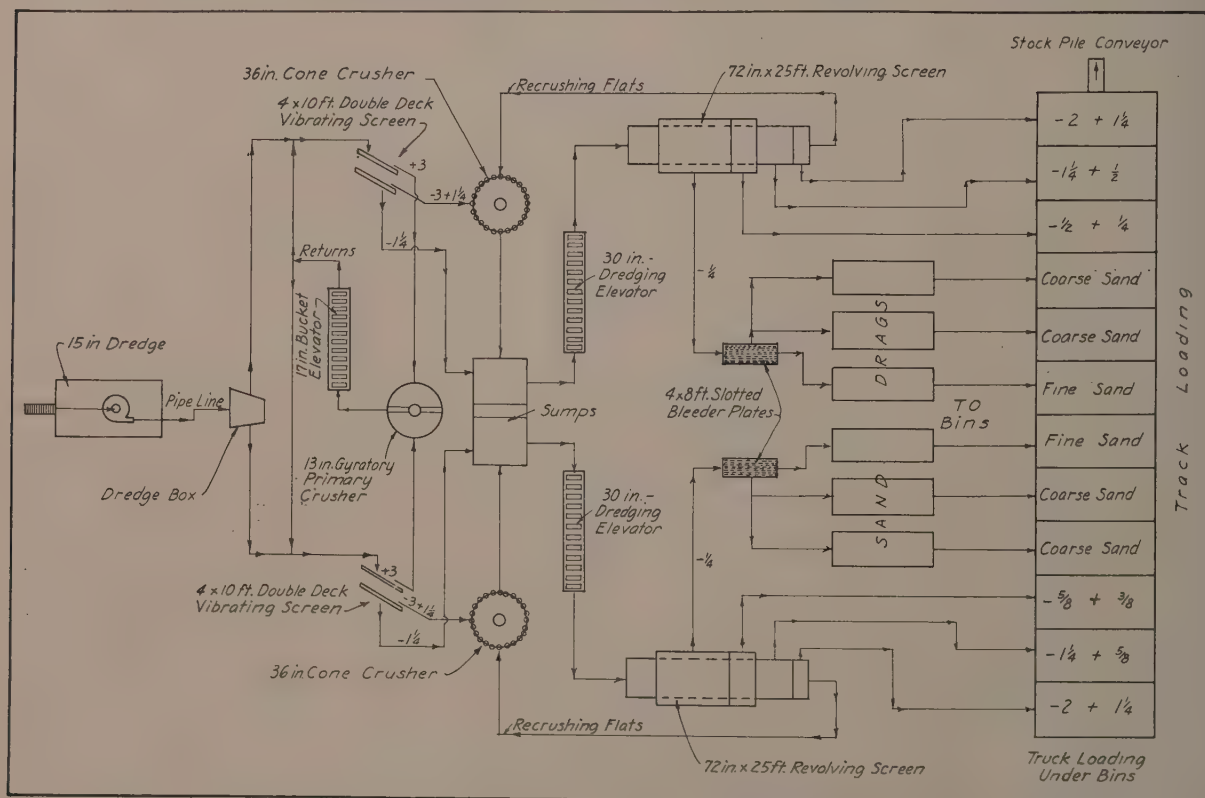
**TABULAR ANALYSIS OF THE OPERATIONS AND EQUIPMENT OF THE CURTIS & HILL GRAVEL & SAND CO.
PLANT AT MORRISVILLE, PA.**

Operation	Equipment	Make	Model No., Size, Capacity or Type	Power Source	Power Transmission
Dredging	Screen-nozzle ladder	Eagle Iron Works	50-ft. "Swintek," 18-in. suction	40-hp. G. E. squirrel-cage motor, 900 r.p.m.	Texrope and gear
	Dredge pump	Hetherington & Berner	15-in. manganese, roller-bearing	500 hp. G. E. slip-ring, 514 r.p.m.	Direct-connected, flexible coupling
	Hoist	American Hoist & Derrick Co.	5-drum	40-hp. G. E. squirrel-cage, 900 r.p.m.	Silent chain
	Service pump	Fairbanks-Morse	2-in. centrifugal	20-hp. G. E. squirrel-cage, 3,600 r.p.m.	Direct-connected
Scalping and crushing	Scalping screens (2)	Telsmith	4-ft. by 10-ft. double-deck vibrators	7½-hp. G. E. squirrel-cage inclosed	Texrope
	Primary crusher	Telsmith	13-in. steel gyratory	50 hp. G. E. slip-ring, 1,150 r.p.m.	Texrope
	Secondary crushers (2)	Telsmith	36-in. cone	60-hp. G. E. slip-ring, 1,150 r.p.m.	Texrope
	Belt-elevator	Telsmith	17-in. buckets, 43-ft. centers	10-hp. G. E. squirrel-cage, 1,150 r.p.m.	Texrope and gear
Sizing and washing	Dredging elevators (2)	Link-Belt Co.	30-in. buckets, 94-ft. 8-in. centers	75-hp. G. E. slip-ring, 1,150 r.p.m.	Texrope and gear
	Sizing screens (2)	Telsmith	72-in. by 25-ft. rotary	25-hp. G. E. slip-ring, 1,150 r.p.m.	Texrope
	Sand-classifier (6)	Telsmith	60-in. by 32-ft. drop	7½-hp. G. E. squirrel-cage, 1,150 r.p.m.	Reduction gears
Storage system	Storage-bins (12)	Belmont Iron Works	300-ton steel		
	Gravel-gates (22)	Telsmith "Siquad"	16-in. by 18-in. (12)		
			24-in. by 18-in. (10)		
	Sand-gates (12)	Telsmith "Siquad"	16-in. by 18-in. (6)		
			24-in. by 18-in. (6)		
	Conveyor-loading gates (16)	Telsmith "Boquad"	16-in. by 18-in.		
	Tripper	Link-Belt	3-spout traveling type	7½-hp. G. E. slip-ring	Jones speed-reducer
	Bin conveyor	Stearns idlers	24-in. on 143-ft. centers	15-hp. G. E. slip-ring	Jones speed-reducer
	Connecting conveyor	Goodyear belt	24-in. on 114-ft. centers	20-hp. G. E. slip-ring	Jones speed-reducer
	Stock-pile conveyor	Medart pulleys	24-in. on 372-ft. centers	Gasoline engine	
Water-supply	Crane	Link-Belt	1¼-yd. crawler type		
Water-supply	Wash-water pumps (2)	Worthington	6-in. centrifugal, 2,000-g.p.m. at 155 ft.	100-hp. G. E. squirrel-cage, 1,750 r.p.m.	Direct-connected
	Priming pumps	Quimby	1-in. centrifugal	1½-hp. G. E. squirrel-cage, 1,750 r.p.m.	Direct-connected

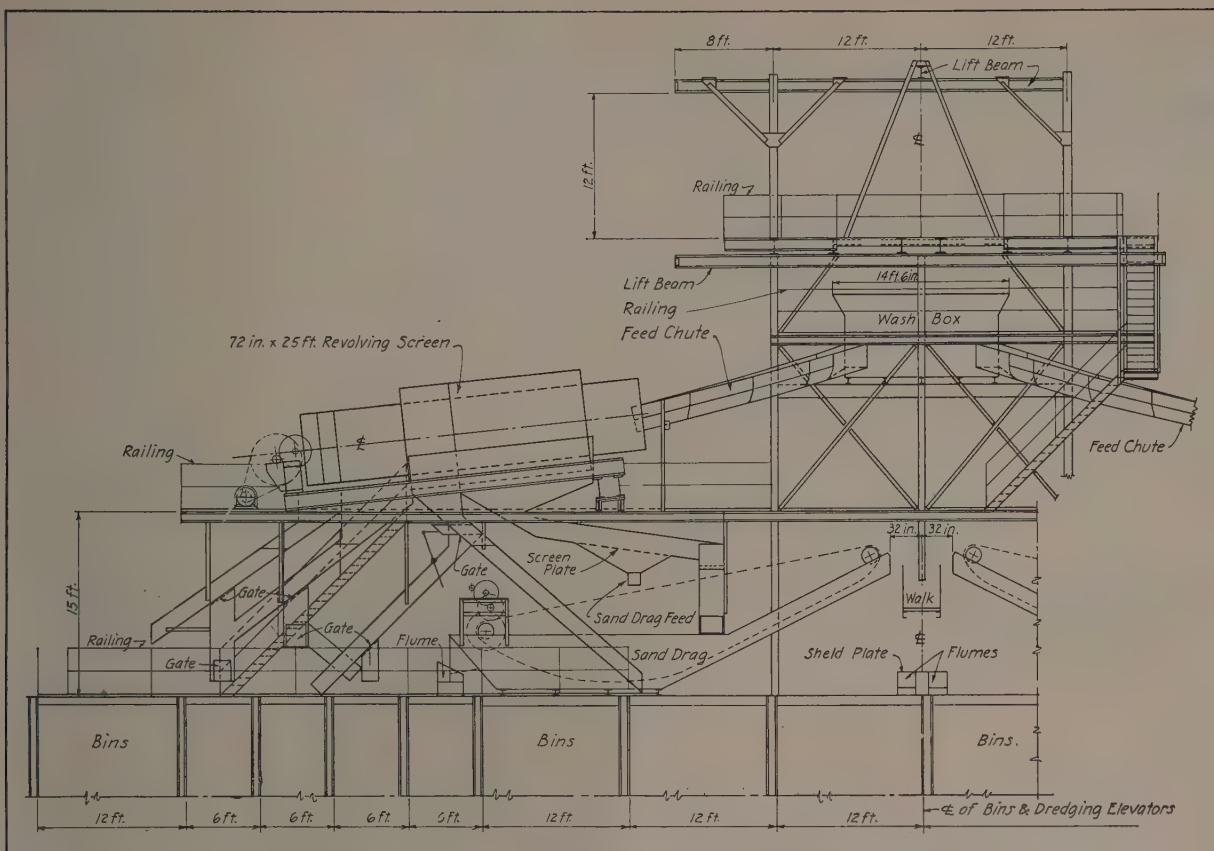
The cleanliness of the product is insured by the unusual number of washing stages incorporated in this plant. Beginning with the soaking and scouring of the material as it is excavated and handled by the dredge and ending with the final rinsing over perforated chutes as it is being loaded or stock-piled, the product is given seven separate washings. Low operating cost is assured by the simplicity of the operation, the high quality of the

equipment used, and the small amount of rehandling required. The all-steel and concrete construction insures the minimum maintenance expense.

Because of the location of this plant near a major highway and a main-line railway and the fact that it would be a show place because of its importance, an attractive appearance was also considered essential. This was kept in mind in the design of the plant and the neatness of the grounds around it.



Flow-sheet showing all operations except stock-pile storage.



Partial cross-sectional elevation of the screening building showing dredging elevator discharge box, one of the revolving screens, one of the sand drags and a portion of the bin structure.

Further to improve the appearance of the plant and to protect the steel from deterioration, the bins and steel work and all the operating equipment were painted with du Pont aluminum paint. As a result, the plant presents an attractive appearance which is in keeping with its other outstanding qualities.

The property on which this plant was built is located about 1 mi. south of Morrisville, Pa., on U. S. Highway No. 1. It is bounded on one side by the Morrisville yards of the Pennsylvania Ry. and on the other by the Delaware Canal.

The rich gravel deposit in this section of Pennsylvania is one of the two main sources of this material in the state. Most of the aggregate used for building construction in the Philadelphia and Trenton areas and for Pennsylvania and New Jersey highway work within a reasonable distance comes from the Morrisville district, as it is known in the industry.

The overburden averages less than 1 ft. in depth and is caved in with the sand and gravel. The deposit contains sand and gravel in almost equal proportions and has been tested to a depth of 70 ft. About 80 per cent. of this is below water level and, because of its loose formation, forms an ideal deposit for hydraulic-dredge excavation. The gravel, which is of a uniformly high quality, is well-graded with very little over 5 in. in size. Occasionally, however, boulders up to 12 in. in size and a few flags up to 36-in. size are found.

Dredge.—The dredge which supplies material to

this new plant was assembled on the property and was launched in an artificial pond dug out by a clam-shell crane. The dredge further enlarged this pond while the plant was in the last stages of construction, so that, when the plant was completed, there was no delay in supplying it with suitable material. The dredge is an all-steel unit of the most modern design, offering the best in low-cost operation, dependability, ease of control, and light, ventilation and safety for those employed on it.

A 50-ft. Eagle Swintek screen-nozzle ladder feeds a continual supply of material to the 18-in. suction nozzle, the flexible suction hose next the pipe-line on the dredge feeding the 15-in. Hetherington & Berner centrifugal dredge pump. This unit has an 18-in. suction and a 16-in. discharge and is mounted on the same base with its 500-hp. motor to which it is connected by a flexible coupling. A speed reduction of 50 per cent. is provided for this motor through a drum-type controller and continuous-duty grid mounted overhead. The main pump bearing is a complete SKF anti-friction bearing complete in one large housing. This pump is primed by an ejector operated by a high-pressure water stream from a 2-in. Fairbanks-Morse single-stage centrifugal pump, which also supplies water to the gland connection at the stuffing-box and serves as a deck and bilge pump.

An American Hoist & Derrick Co. 5-drum, heavy-duty hoist raises and lowers the ladder and operates the two front shore-lines and the two spuds at the



View of plant showing, left to right, conveyor to stock-pile storage system, screening plant and bins, batching unit, dredging elevator and sump, and crushing-and-scalping building.

rear end of the dredge. From the operator's platform a clear view of all dredging operations is obtainable and all control equipment is conveniently grouped near this platform. This includes the hoist-lever bank, the pressure and vacuum gauges, ammeter and voltmeter, dredge-pump controller, etc.

The main hull of the dredge is 70 ft. long, 26 ft. wide, and 5 ft. deep and is composed of six rectangular sections, each containing two water-tight compartments. The four outer sections are longer than the inner ones, forming a well 12 ft. long and 12 ft. wide at the forward end of the hull. This supports all the dredging equipment and the upper end of the dredging ladder. The other end of the ladder

is supported on two pontoons, each 27 ft. long, 9 ft. wide, and 4 ft. 9 in. deep, located 10 ft. apart and 20 ft. ahead of the main hull, to which they are connected by laced struts and hinge pins. The ladder is supported from a structural-steel gantry crane mounted across the forward end of the pump. This arrangement allows unrestricted vertical movement of the pontoons under digging conditions without transferring these stresses to the main hull. Both the dredge hull and the pontoons are of welded steel-plate construction, covered inside and out with asphalt paint.

The two 60-ft. steel stern spuds on this dredge are an unusual feature in an operation using the Swintek type of ladder dredge. They get their bearing through vertical, latticed column guides, which are joined by cross braces at the top and the bottom and are carried on the hull in such a manner that their load is evenly distributed.

The superstructure inclosing the dredge pump and other operating units is of structural steel covered with galvanized corrugated metal. The entire forward end is a large steel-sash window. Additional steel-sash windows at the aft end and along the sides give ample light, and two roof ventilators insure good ventilation. An overhead trolley and chain-hoist allow all heavy parts to be easily handled. No details were neglected in providing for the safety of those working on the dredge. These provisions include wire-screen inclosures for the transformers, rubber safety mats below all switches, hand rails around machinery and the edge of the hull, and stairways over obstructions, such as dredge-lines, etc.

The special pipe-line fittings used in the dredge are of manganese steel. The dredge pump is equipped with a manganese shell, impeller, and re-

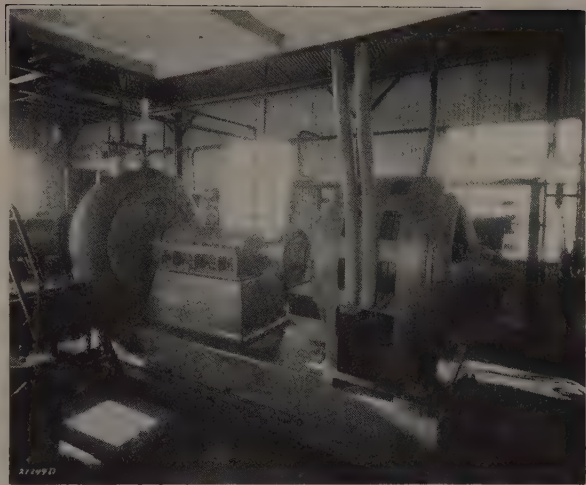


Close view of dredge ladder showing drive, flexible pipe-line connection and large windows.

movable disk and throat liners. The dredge pump discharges through a flap valve to a 16-in. steel pipe-line which is connected to the dredge by a 10-ft. section of rubber hose. The discharge-line is carried on rectangular welded-steel pontoons provided with steel pipe supports and bracket arms for the cable. At the shore end the pipe is carried over a railroad track and roadway to the discharge box in the scalping building by means of structural-steel supports.

Crushing and Scalping.—The dredge-line discharges at the top of the crushing and scalping plant into an inclined fan-shaped box which reduces the velocity of flow. This box discharges through a Y-shaped flume to the two scalping screens. A radial gate in the flume divides the flow to the two screens and can close off either side entirely. The two scalping screens are Tel-smith, 4-ft. by 10-ft., heavy-duty, double-deck vibrators. The screens differ from the ordinary vibrating screen in that each deck is equipped with a separate set of exactly-opposed eccentric bearings. This eliminates the necessity of balance wheels and results in an almost vibrationless unit. Screen cloth with 3-in. square openings on the upper decks scalps the "oversize" rock to a chute leading to a 13-in. Tel-smith gyratory primary crusher which is set at $1\frac{3}{4}$ -in. opening. The lower decks can be fitted with either $1\frac{1}{8}$ -in. or $1\frac{3}{4}$ -in. cloth, depending on the demand for more sizes. Rejections from the lower decks drop through dewatering chutes to two Tel-smith 36-in. cone crushers set at $\frac{3}{4}$ in. The sand and water, together with the sized gravel passing through the lower decks, go to a double sump.

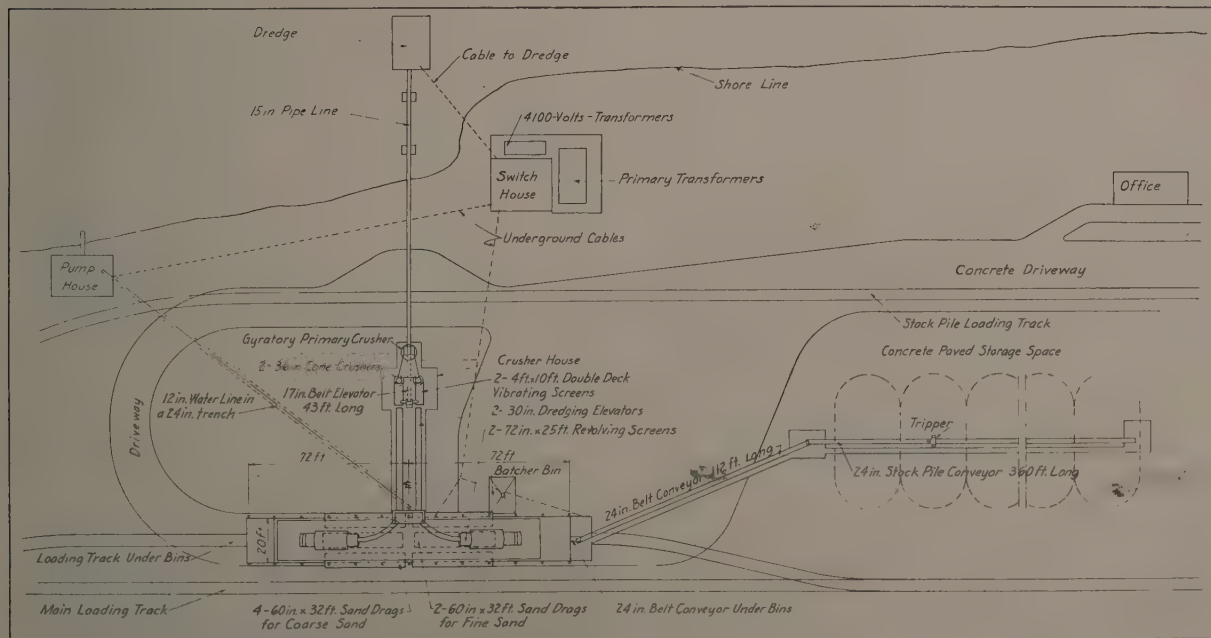
The product of the primary crusher is returned by a 17-in. bucket-elevator, which discharges through a split chute back over the scalping screen. The product of the cone crushers is discharged to the elevator sump.



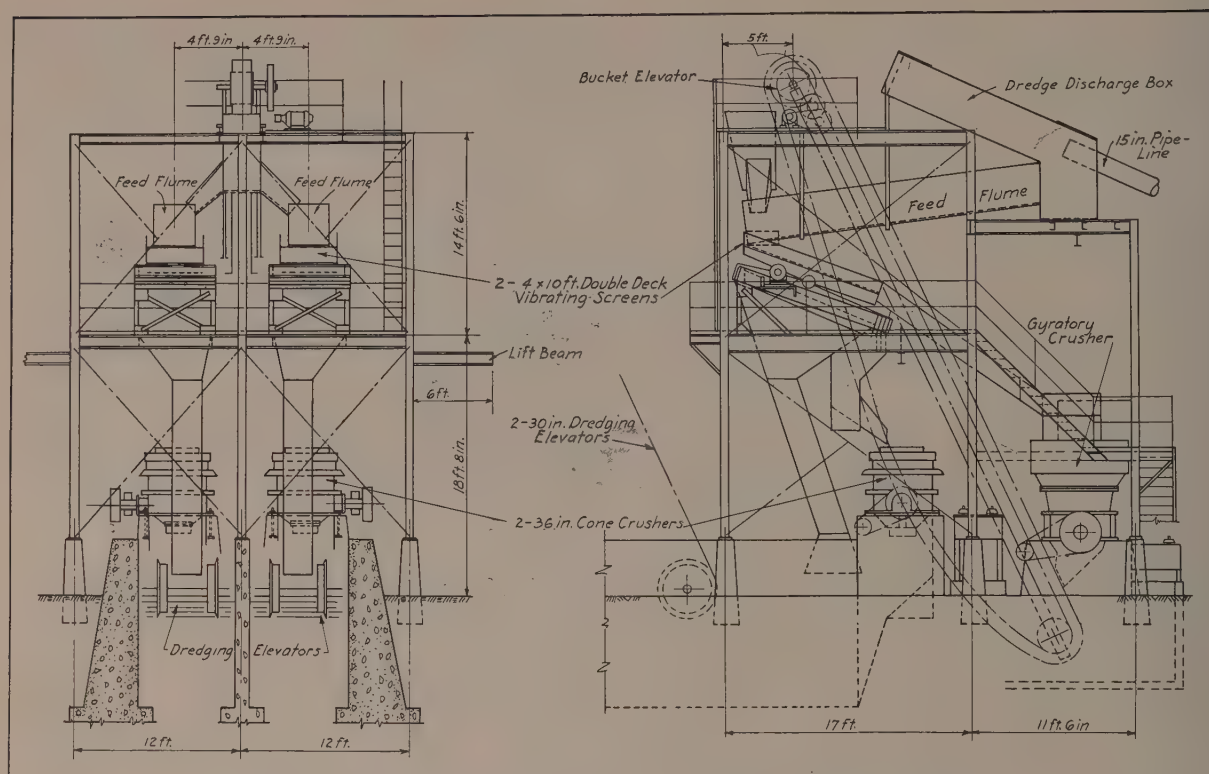
The 15-in. dredge pump with its 500-hp. motor and single large anti-friction bearing.

Each of the two reinforced-concrete sumps is 41 ft. long, 6 ft. 6 in. wide, and 12 ft. deep. Each has an overflow to carry off foreign material. This overflow can be regulated to control the percentage of sand going to the screening plant. Pipe connections at the side of each sump allow the sumps to be cleaned whenever desired, and steam connections are installed for cold-weather operation. The overflow from these sumps, together with the drainage from the screening plant and bins is carried back into the dredge pond by a 4-ft. square underground concrete tunnel.

Two Link-Belt dredging elevators excavate the material from the sumps and elevate it to the top of the screening plant. Each of these elevators has a capacity of 275 tons per hr. at a speed of 75 ft. per min. They operate on 94-ft. $8\frac{1}{4}$ -in. centers and



Plan of the entire operation of the Curtis & Hill Gravel & Sand Co.



Side and end cross-sectional elevations of the scalping-and-crushing building.

have 30-in. by 18-in. by 16-in. manganese-lipped buckets carried on 17-in. heavy-pitch manganese chain. Any possibility of reversal of these elevators under load is eliminated by automatic differential band-brakes.

The two elevators are supported on a heavy structural-steel frame, which transmits its load to the ground independently of any of the other structures. A steel ladder between the two elevators makes any part of these units accessible for inspection or repair at any time. The return strands of these elevators are inclosed in steel-plate casings and splash pans along the entire length of the incline return any grit or overflow to the sumps.

The crushing-and-scalping building is a com-

pactly-designed steel-frame unit supported on reinforced-concrete foundations, which were poured integrally with the dredging-elevator sumps. Steel stairs and walkways on this structure give access to all operating units. Trolley beams are located for the convenient handling of heavy parts by means of chain-hoists.

Screening and Classifying.—The dredging elevators discharge into a steel mixing box at the top of the screening plant. This box discharges through a split chute to two rotary screens and has an adjustable partition-plate for diverting the entire flow to either one of these screens when desired. Two 6-in. spray-pipes agitate and soak the material as it leaves the box. The chutes are rubber-lined. The screening units are Tel-smith, Hercules 72-in. by 25-ft. scrubber screens which are Timken-bearing equipped.

Each screen has a 5-ft. blank scrubber section and a 7-ft. perforated scrubber section, where the material gets an additional washing from a 5-in. spray-pipe. The material passing through this section drops on an 11-ft. sand jacket. On the main barrel two larger sizes of gravel are screened out and provisions are made for mixing these sizes when desired. Rejections from the main barrel, consisting mainly of flats, are returned, through Ransome steel chutes of the type used on concrete-construction work, to the two cone crushers for further reduction. The smaller sizes of gravel rejected by the 7-ft. sand jacket go to a tandem jacket 4 ft. long. The products of these jackets are chuted directly into bins or can be mixed with minus-1¼-in.



The five-drum hoist operating the screen-nozzle ladder, the two shore lines and the two stern spuds.

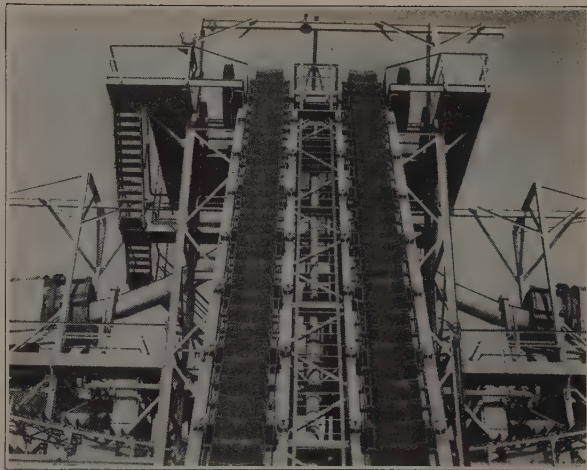
gravel to form graded commercial $\frac{3}{4}$ -in. gravel. The three sizes of gravel ordinarily produced are chuted directly to bin-storage. These gravel chutes have heavy renewable liner-plates and the gravel is rewashed over perforated plates with clean-water sprays before going to the bins.

The water and sand passing through the outer jackets of the screens are flumed to two 4-ft. by 8-ft. slotted bleeder-plates. The amount of fine sand removed can be controlled at this point by taking out or inserting blank plates or by the adjustment of the water-spray pressure on these plates. The amount of fine sand removed is generally governed by the percentage required to meet specifications for concrete sand. The material passing across each of these two plates is split to two 60-in. by 32-ft. Tel-smith steel-box, continuous-type sand-drags. These dewater and discharge the concrete sand to bins below. The fine sand, minus $\frac{1}{8}$ -in., passing through each of these plates goes to a third sand-drag located between the concrete sand-drags.

These sand-drags were made considerably longer than is the customary practice in order to insure the driest possible product. Together, the six drags have a capacity of 500 tons per hr. They are driven through completely-inclosed reduction gearing and are equipped with removable wearing plates. Steam-pipe connections allow these units to be operated in cold weather.

The entire washing-and-screening plant is supported above the bins by rigidly-braced structural-steel framework. An extensive system of walkways, stairways and ladders gives access to all operating machinery.

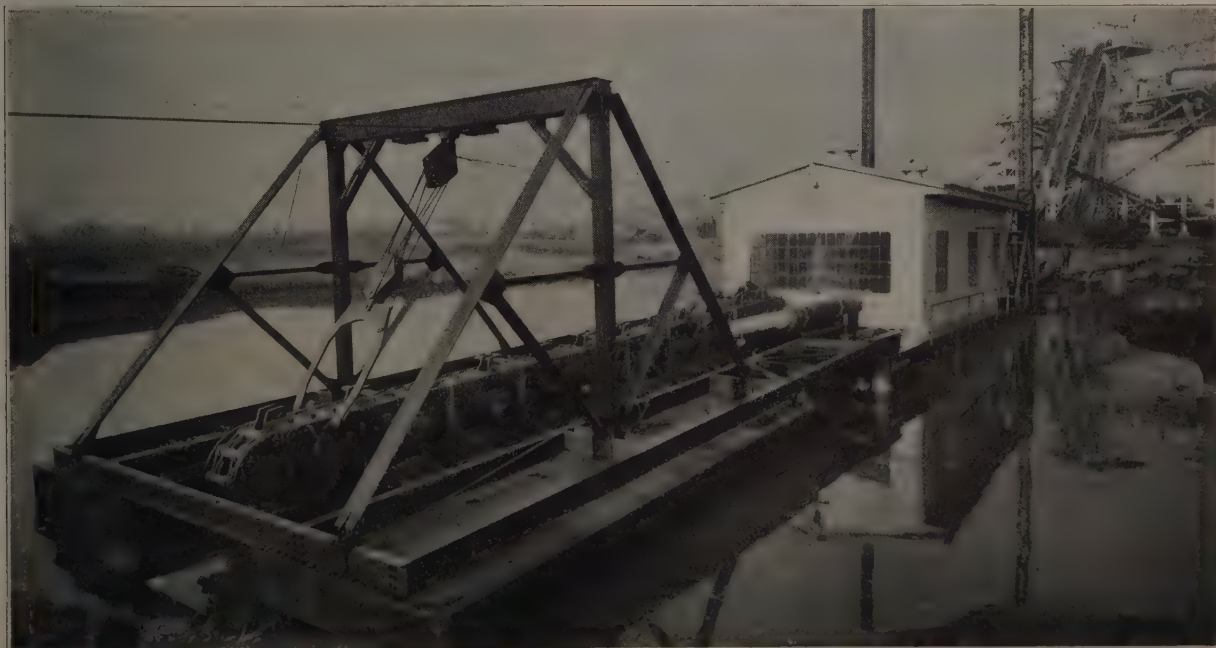
A complete monorail system, with trolleys for serving the screen deck, has a landing platform at its east end. A similar system is provided over the platform around the dredging elevator head-frame.



The two dredging elevators and discharge to the two sizing screens.

Storage-Bins.—The bin-structure supporting the washing, screening and classifying plant consists of twelve units, each 12 ft. long, and 21 ft. 2 in. wide and with a live capacity of 300 tons. Each of the bin units is hopped both ways to be self-cleaning. The tops of the bins are 48 ft. and the bottoms of the hoppers 18 ft. above ground level. Fourteen-inch, 100-lb. H-columns, resting on reinforced-concrete foundations, support the bin-structure. The side and bottom plates of the bins are reinforced with horizontal and vertical stiffeners. Transverse partitions in four of these bin units allow additional sizes of material to be stored. The main partitions between the bins are designed as girders, and continuous struts absorb the horizontal stresses created by an unequal amount of material stored in adjacent bin sections.

Alongside one end of the bin-structure is a batch-



A view of the dredge showing the pontoon arrangement supporting one end of the 50-ft. screen-nozzle ladder. Note the two steel stern spuds.



Looking from the end of the stock-pile storage system toward the plant.

ing unit, consisting of a 40-ton sand bin and an Erie 3-way Aggremeter. The sand bin is fed direct from one of the classifiers to a chute, and gravel is fed directly to the Aggremeter by chutes from either of the two end bins on the south side of the bin-structure. Another 500-ton batching plant will later be erected alongside the stock-pile storage.

Aggregates are withdrawn from these bins through three separate systems. Gates at the apex of the hoppers along the center-line lead to a stock-pile conveyor; gates under the southside hoppers are used for either truck- or car-loading; and gates with long chutes feed from the bottom of the north-side hoppers for car-loading. For the present only

The rinsing chutes between the gates and the loading chutes are of particular interest. These rinsers are extremely efficient and insure the high quality of the product by removing any coating acquired by the gravel while it is stored in the bins. These rinsers were invented by H. F. Curtis, president of the company. Each consists of a side-staggered slotted plate on which water is sprayed at 40 to 50 lb. pressure from nozzles at three successive



One of the two double-deck opposed-eccentric vibrating scalping screens.



The crushing and scalping plant. Primary crusher at left and one of the secondary cone crushers at right.

trucks will be loaded underneath the bins, but tracks have been laid in the concrete pavement so that railroad cars can also be loaded, in case additional loading capacity is desired, or when a complete cleaning out of both sides of the bins is desired. Steam-pipes in the lower part of these hoppers prevent freezing of the material around the gates in cold weather.

levels. Special quick-opening valves control the water flow. Waste water under the perforated plates is collected in a hopper which feeds flumes that discharge to the main overflow tunnel. All the gravel-loading chutes in this plant are equipped with these rinsers, and in addition have right-angle hoppers at the ends of the chutes to prevent segregation in car-loading. Stairways, walkways and ladders give ready access to all the gates and bins.

Stock-Pile Storage System.—The stock-pile storage system previously mentioned was designed to allow the storage of excess production which may occur in certain sizes and to allow adequate reserve storage. Gravel is recovered from the bins to Tel-

smith Boquad gates at the apex of the hopper angle. These discharge to a 24-in. horizontal belt-conveyor, which operates on 143-ft. centers and extends the length of the bins. This conveyor discharges to a second 24-in. belt-conveyor, which operates on 112-ft. centers and is slightly inclined and which is supported on a single-span steel framework. This conveyor, in turn, discharges to a 24-in. horizontal stock-piling conveyor, which operates on 360-ft. centers at an elevation of 35 ft. above ground level.

Material is distributed from the stock-piling conveyor to any of six bays provided below by means of a 2-spout belt-propelled tripper. The ground space underneath the storage conveyor is paved with concrete, and stored material can be recovered by crawler or locomotive crane to cars on railroad

tensive concrete-roadway system extending from the east end of the plant to the modern brick office building more than 800 ft. distant. This system involved over 7,000 sq.yd. of concrete pavement.

The stock-piling conveyor and the connecting conveyor are supported on a structural-steel framework whose columns are supported on a concrete frame. Belt-conveyors have Stearns roller-bearing idlers, Goodyear Style belting, and are individually driven through Jones speed-reducers. The storage and



One of the sizing screens showing scrubber section and tandem sand jackets.

loading tracks located on both sides of the storage at 130-ft. centers. Curtis washing chutes again rinse the gravel before it goes to storage. A drainage-pipe system carries the wash-water to a 20-in. underground concrete pipe.

The present stock-pile storage capacity is approximately 30,000 tons. This can be increased, however, by extending the present conveyor which can readily be done at any time and for which ample space is available. The concrete paving under these stock-piles is pitched from the center-line, providing natural drainage and an ideal surface from which to recover aggregates. This paving is part of an ex-



One of the two revolving screens with sand-drag below. Chute returning flats to crusher at right.

connecting conveyors are provided with gravity take-ups for maintaining belt tension and the bin conveyor has a screw take-up. Each conveyor has a belt-scraper for cleaning, and the stock-piling conveyor, in addition, has a rotary brush.

A portion of the pond created by dredging has been separated by a steel sheet-piling bulkhead from the main part of the pond in which the dredge is operating. In this manner a plentiful supply of clean wash-water is assured. A concrete-block pump-house is located near the bank of this pond and its footings are protected by a sheet-piling retaining wall. This building is 26 ft. long and 17½ ft. wide.

Each of two Worthington 6-L-3 single-stage centrifugal pumps in this building delivers about 2,000 gal. per min. to the plant against a total dynamic head of 155 ft. These pumps are primed by a Quimby 1¼-in. centrifugal pump equipped with an



Two-way belt-driven traveling tripper on stock-pile storage-conveyor system.



One of the centrifugal pumps furnishing wash water for the plant.



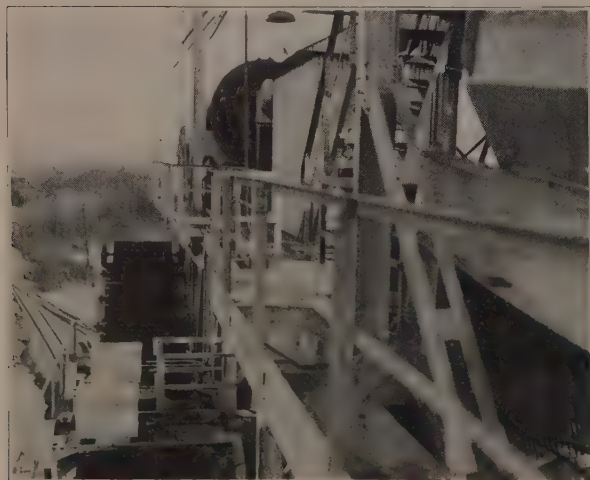
Speed-reducer drive of conveyor connecting to stock-pile storage conveyor.

Apco automatic primer. Water is drawn from the pond to a single 16-in. suction pipe equipped with a foot valve and strainer and having a "T" from which 8-in. suction connections are carried to the pumps. Space and connections are provided for the future installation of a third pump.

The pumps discharge to a 12-in. discharge-header, carried in a steel-plate-covered trench a distance of 230 ft. to the screening plant. The feeder-line slopes upward toward the plant and, at its low point alongside the pump-house, has an outlet and valve which allow the system to be completely drained in cold weather. A 12-in. line carries the water to the top of the plant, where 6-in. lines supply the spray-pipes on each side of the mixing box while additional 6-in. lines supply laterals which feed water to the sizing screens, bleeder-plates, chute sprays and sand-drag sprays. Water for the Curtis washing chutes under the bins and on the storage conveyor is supplied through 2-in. lines tapping the main supply-line at the bottom of the bins.

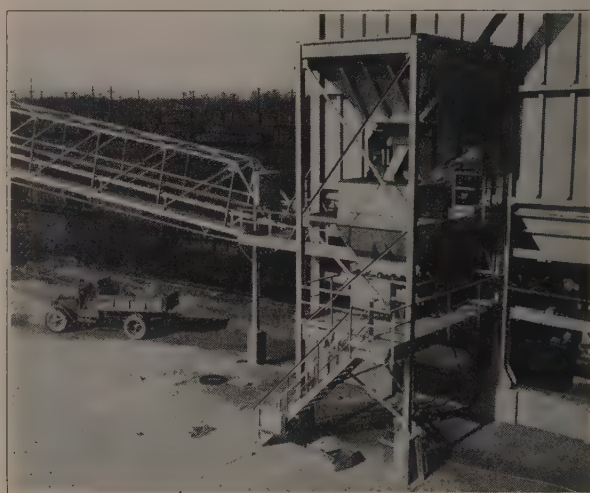
The system recovering waste-water and overflow from various plant operations is quite complete. Overflow from the sand-drags is delivered to the waste-water tunnel through a 20-in. spout and the discharge from the rinsing chute is flumed to the same tunnel. The six sand-drags have an auxiliary drainage system which allows them to be cleaned whenever desired. As has been previously stated, an independent drainage system collects dirty water from the washers on the storage conveyor. This is fed back into the dredge pond through a 20-in. concrete underground pipe.

Power-Supply.—This plant is served from a 13,000-v. line, which extends from the Morrisville switching tower of the Philadelphia Electric Co. to its Yardley substation. This tower is supplied by two 13,000-v. lines from the Emilie substation, where a 66,000-v. current is reduced to 13,000 v. The sand plant, therefore, may be supplied from either of the two 13,000-v. lines mentioned above, or the Yardley line may be disconnected at the switching tower and power obtained direct from the Yardley substation.



View alongside plant showing one of screens and two of the sand drags.

The plant substation, located near the pump-house and only a short distance from the crushing plant, is a concrete-block building with monolithic concrete piers supporting the primary and secondary transformers. The incoming current is first delivered to buses feeding the 333-kva. primary transformers outside the building. The 4,000-v. potential from the low side of these transformers is carried to meters inside the building. This current is distributed two ways by oil switches mounted on three separate panels. One of these feeds the submarine cable to the dredge, while the plant power goes to the three 350-kva. secondary transformers outside the building. These reduce the voltage from 4,100 to 440 for plant use. Buses feed from these transformers to three distribution panels inside the building. Each panel is equipped with an oil switch supplying: (1) main plant building and storage conveyor, (2) the pump-house, and (3) the



The present aggregate-batching unit at the stock-piling end of the storage bins.

crushing and scalping building through underground feeder lines.

Three additional panels in this building carry starters, time interlocks, overload relays, and contactors for the three crusher motors. Starters for the scalping screens and return-elevator motors are mounted on the wall of this building and push-button stations at the crusher-house provide local control. Starters for the water pumps are mounted on the wall of the pump-house. An inclosed control-house on the screen-deck of the plant houses starters for the dredging elevators, rotary screens, and sand-drags. Each individual unit is also locally push-button controlled. Windows in this building overlook the entire plant. Starters for the stock-piling conveyor motors are located on a platform near the bins.

The Roebling armored submarine cable carrying 4,000-v. power to the dredge is supported on the dredge-line pontoon. This cable has oil switches at each terminal and the dredge motor is supplied direct. All other motors on the dredge are supplied with 440-v. current from three 37½-kva.



Cars being loaded through rinser chutes. Chutes beneath bins are used for car or truck loading.

4,100/440-v. transformers inclosed in a wire-screen partition. A single-phase lighting transformer supplies lighting for the dredge. Six 500-w. flood lights and many outlets for reflecting units provide ample illumination for night operation of the plant. Five-hundred-watt flood lights at each end of the dredge and smaller lights inside the dredge are also provided. All the motors as well as most of the transformers, switches and other electrical equipment, were furnished by the General Electric Co. Crouse-Hinds conduit is used throughout the plant. The electrical installation was made by the Franklin Electric & Construction Co. of Pittsburgh, Pa.

The officers of the Curtis & Hill Gravel & Sand Co. are: H. F. Curtis, president and treasurer; H. L. Curtis, secretary; and T. E. McCue, sales manager. H. F. Curtis is well known as a former plant operator and, more recently, as a railroad contractor. He personally supervised the construction of this new plant and the reestablishment of the company in the gravel business. The company was originally organized in 1918, and for several years operated in the Morrisville area a plant which was leased to another company in 1925. The general offices of the company are in the new Broad Street Station Building in Philadelphia.

The plant was designed and built by the Pittsburgh Engineering, Foundry & Construction Co. in collaboration with the Smith Engineering Works with A. R. Amos, Jr., as resident engineer. The Belmont Iron Works fabricated and erected most of the structural steel. The dredge was designed and erected by Hetherington & Berner, Inc.

British Cement Prospects Improve with Monetary Depreciation

In six years British cement production has increased from an annual output of 2,742,000 metric tons to 4,766,000 tons. It ranks second among European cement-producing countries, immediately after Germany. It stands third in exporting countries, after Belgium and Germany. Exports run to 1,000,000 or more tons a year, but the country also

imports nearly a third of this bulk. Exports, with the reduced value of the pound sterling being around 20 per cent., are likely soon to increase to such an extent that all other cement-exporting countries will feel the competition of Great Britain as they have never sensed it previously. This presumes that production costs do not go up, which seems hardly likely, at least for the present. Raw materials and fuel are likely to be held at present values, and living costs of the workers—the weak point in the situation—are probably as likely to go down as up.

British opinion is that the industry can only benefit from the depreciated value of the pound sterling. Imports have been declining in volume and value during the past three years and are still small with relation to exports. Exports during the first three months of the present year were above \$5,000,000 in value, while imports hardly reached \$1,000,000.

It is believed that a large increase in domestic consumption may also be looked for, with the extension of factory building, to say nothing of the road-building program which, in view of the economic value of road transports, can hardly be curtailed in spite of the rigid economy to which the new government is committed.

Financially and physically the British cement industry is healthy. The leaders of the industry, as represented by the Portland Cement Manufacturers' Assn., owns over 70 per cent. of the ordinary capital of the British Portland Cement Manufacturers, the second largest group, while last summer it got possession of the assets of the Allied Cement Manufacturers, better known as the "Red Triangle" group. The parent organization now controls nearly 75 per cent. of the entire British output.

Distribution of Sales by Portland Cement Plants Revealed

Three-fourths of the sales (as measured by value) by manufacturing plants engaged primarily in making cement are made to building-supply dealers or distributors. Data collected for the Census of Distribution show that, of the total distributed sales made by these plants in 1929, amounting to \$255,604,000, 76.9 per cent., or \$196,539,000, was made in this way.

The total sales in 1929 by the plants included in this industry amounted to \$267,509,000. Eight plants reporting \$11,905,000 of this amount were unable to classify their sales according to types of purchasers. The percentages in this report are based on the \$255,604,000 which was distributed by 166 manufacturing plants. Of this latter sum, 16.8 per cent., or \$42,978,000, was sold to consumers, such as contractors, governments, railroads, etc.

Manufacturing plants sold 6.3 per cent., or \$16,087,000 worth, of products to their own wholesale branches (silos or warehouses). This report does not show the distribution of the sales of these sales branches.

A Coördination of Old and New Laws of Concrete-Mixture Formulation

By JOSEPH A. KITTS
Consulting Concrete Technologist

THE new method of mixture formulation, presented herein, was developed to meet the exacting and various requirements of commercial concrete manufacture. It is equally applicable where concrete is made on the job. The method is a coördination of basic principles of mixtures advanced by Thacher, Feret, Fuller, Talbot, Abrams, the present author, and other workers in concrete research. By this coördination of the various fragmentary principles of mixtures it becomes possible to produce superior concretes, correct in yield, strength and slump; uniform in texture, density, impermeability, workability, etc.; and with greater economy. The method of calculation is so simple that the technical student can acquire it in a few hours' study.

The criteria of material quality and the skill of mixture control, determining the equation constants employed herein, are those of Figs. 1 and 12, *Design and Control of Concrete Mixtures* (2d Ed., Jan., 1927), and other data published by the Portland Cement Assn. These criteria are for rounded-gravel aggregates of standard quality, normal standard Portland cement (prior to 1927), and the skilled control of the water-cement ratio and the measurement of the ingredients. Preliminary to production on a project or at a central plant, comprehensive tests of concrete of the local materials should be made to determine the constants in equations 1, 2 and 5, hereunder.

The notation used herein refers only to the particular subject and may not have the same meaning throughout.

Cement-Content Law.—The law of the cement content for concrete of any strength, maximum size of aggregate, and slump is expressed by the author's equation

$$\log C = bS + a \quad (1)$$

in which C is the cement content in a unit volume of concrete, S is the compressive strength, and a and b are constants for a given condition of maximum size of aggregate and slump of concrete of given materials. The value of a varies as the slump for a given maximum size of aggregate, and varies inversely as the logarithm of the maximum size of the aggregate for a given slump. The values of a and b depend, also, on the character of cements and aggregates, manufacturing facilities, and the skill of proportioning control.

This relation of cement content to strength, for a given maximum size of aggregate and slump, is shown to hold, also, for high-early-strength Portland cement for ages of 2, 3, 7 and 28 days. (See Fig. 7, *Tests of Powdered Admixtures*, by Duff A. Abrams, Proceedings, American Society for Testing Materials, xxix, pt. 2, 1929.)

Practical values of a and b for normal Portland cement, gravel aggregates of standard quality, and skilled control, are given in Table I.

TABLE I. CEMENT CONTENT FOR RIGID CONTROL BY ABSOLUTE VOLUME

Constants for Determining Pounds of Normal Standard Portland Cement per Cubic Yard of Concrete for any Compressive Strength (at 28 days) for Given Slumps and Maximum Sizes of Aggregates, Employing the Equation, $\log C = bS + a$, and Based on the Water-Content Equation, $W = 0.0125 C (4.14613 - \log S)$.

(For average commercial gravel aggregates of standard quality)

(1) of average commercial gravel aggregates of standard quality						
Standard Slump ¹ (in.)	Maximum Size of Aggregate (in.)					Approximate Flow
	Square-Hole Screen Sizes (in.)					
	¾	¾	¾	1	1½	
	Round-Hole Screen Sizes (in.)					
	.225	.45	.9	1.2	1.5	
a	2.5236	2.4104	2.3200	2.2786	2.2474	14C
b	.0001084	.0001224	.0001335	.0001386	.0001424	
a	2.5497	2.4348	2.3400	2.2972	2.2648	162
b	.0001077	.0001221	.0001341	.0001395	.0001436	
a	2.5758	2.4592	2.3600	2.3158	2.2822	175
b	.0001073	.0001224	.0001352	.0001409	.0001453	
a	2.6019	2.4836	2.3800	2.3344	2.2996	185
b	.0001074	.0001232	.0001371	.0001432	.0001479	
a	2.6280	2.5080	2.4000	2.3530	2.3170	194
b	.0001083	.0001250	.0001401	.0001467	.0001517	
a	2.6541	2.5324	2.4200	2.3716	2.3344	202
b	.0001103	.0001282	.0001447	.0001518	.0001573	
a	2.6802	2.5568	2.4400	2.3902	2.3518	210
b	.0001137	.0001331	.0001514	.0001593	.0001653	
a	2.7063	2.5812	2.4600	2.4088	2.3692	218
b	.0001192	.0001406	.0001613	.0001700	.0001768	
a	2.7324	2.6056	2.4800	2.4274	2.3866	225
b	.0001278	.0001519	.0001758	.0001858	.0001936	
a	2.7585	2.6300	2.5000	2.4460	2.4040	232
b	.0001414	.0001695	.0001980	.0002098	.0002190	
Optimum Slump ²	8.6	8.4	8.0	7.7	7.5	

	Square-Hole Screen Sizes (in.)					
	1½	2	2½	3	6	
	Round-Hole Screen Sizes (in.)					
	1.8	2.4	3.0	3.6	7.2	
a	2.2190	2.1780	2.1428	2.1178	2.0172	140
b	.0001459	.0001510	.0001553	.0001584	.0001708	
a	2.2360	2.1935	2.1576	2.1316	2.0279	162
b	.0001472	.0001525	.0001571	.0001603	.0001734	
a	2.2530	2.2090	2.1724	2.1454	2.0386	175
b	.0001490	.0001547	.0001595	.0001630	.0001768	
a	2.2700	2.2245	2.1872	2.1592	2.0493	185
b	.0001518	.0001579	.0001629	.0001666	.0001813	
a	2.2870	2.2400	2.2020	2.1730	2.0600	194
b	.0001559	.0001624	.0001677	.0001718	.0001875	
a	2.3040	2.2555	2.2168	2.1868	2.0707	202
b	.0001617	.0001689	.0001746	.0001790	.0001960	
a	2.3210	2.2710	2.2316	2.2006	2.0707	210
b	.0001701	.0001780	.0001842	.0001890		
a	2.2380	2.2865	2.2464	2.2144		218
b	.0001821	.0001909	.0001978	.0002032		
a	2.3550	2.3020				225
b	.0001996	.0002097				
a	2.3720	2.3175				232
b	.0002260	.0002379				
Optimum Slump ²	7.3	6.8	6.4	6.0	4.1	

¹ Excluding particles over 1½-in. diameter.

² Slump for optimum workability, flowability, cohesion, strength, density, and economy, for reinforced and difficult sections.

Water-Cement-Ratio Strength Law.—The cement-content law is complementary to the Abrams' water-cement-ratio strength law

$$S = A/B^{w/c}, \text{ or} \quad (2)$$

$W = C(\log A - \log S)/\log B$, as it provides the otherwise unknown value of C for a given maximum size of aggregate and slump.

For the given criteria, the practical equation of the water content, for normal Portland cement and skilled control, is

$$W = 0.0125 C (4.14613 - \log S) \quad (2A)$$

in which W is the number of cubic feet of mixing water per cubic yard of concrete.

The cement- and water-content equations depend upon a corresponding size modulus of aggregate for the required workability and slump.

Aggregate Content.—The law of the yield of combinations, elaborating Feret's theory, is

$Ky = Kv/(Av + Cv + Wv) = 1.0 \pm .03 \pm$ (3)
in which Ky is the yield or ratio of absolute volume of concrete, Kv , to the sum of the absolute volumes of aggregate, cement, and water, Av , Cv and Wv , respectively.

The absolute volume of aggregate in the mix is, then

$$Av = (Kv/Ky) - (Cv + Wv). \quad (4)$$

Practical values of Ky , based on cement content, are as given in Table IV.

Fineness-Modulus Law.—The law of the fineness modulus for any maximum size of aggregate and cement content is expressed by the author's equation

$$f.m. = d(\log C - e) \quad (5)$$

in which d is a constant (1.07 herein) and e is a minus quantity which varies as the logarithm of the maximum size of the aggregate, as given in Table II.

Grading Equation for Three or More Aggregates.—Where three or more size-separations of aggregates are employed, a proper grading for the required fineness modulus is determined by the Talbot-Richart grading equation

$$r = 1 - (s/D)^n \quad (6)$$

in which r is the proportion of the total absolute volume of aggregate retained on and coarser than a given sieve opening s ; D is the maximum size of the aggregate; and n is an exponent depending upon the required fineness modulus.

The fineness moduli of uniformly-graded aggregate mixtures for various values of n and D are given in Table III.

Equations 5 (Kitts) and 6 (Talbot-Richart) coordinate the Thacher sand-cement-ratio law, the Fuller grading principle, the Abrams fineness-modulus principle, and the Feret cement-space principle. The grading of the aggregate for a given cement content is such that the optimum combination of qualities—workability, flowability and cohesion of the fresh mix, and strength and density of the resulting concrete—is obtained.

Proportioning Two Aggregates.—The mathematical principle of simple proportion employed in proportioning two aggregates is as follows:

Let p = the proportion of fine aggregate. Then, $1.0 - p$ = the proportion of coarse aggregate. Let F = the fineness modulus of the fine aggregate; R = the fineness modulus of the coarse aggregate; and M = the fineness modulus of the mixed aggregate. Then

$$M = pF + (1.0 - p)R, \text{ and} \quad (7)$$

$$p = (R - M)/(R - F). \quad (8)$$

Proportioning Three or More Aggregates.—Assume that we have four size-separations of aggregates as given in Table V and that we wish to com-

TABLE II. THE VALUE OF e IN THE FINENESS-MODULUS EQUATION, $f.m. = 1.07(\log C - e)$, FOR VARIOUS SIZES OF AGGREGATES

$e = -2.26607 - \frac{\log D}{.3973}$			
Maximum Size (in.)	e	Maximum Size (in.)	e
$\frac{3}{16}$	.4362	2	3.0238
$\frac{1}{4}$	.7446	$2\frac{1}{2}$	3.2677
$\frac{3}{8}$	1.2139	3	3.4670
$\frac{1}{2}$	1.5084	$3\frac{1}{2}$	3.6355
$\frac{3}{4}$	1.9516	4	3.7815
1	2.2661	$4\frac{1}{2}$	3.9002
$1\frac{1}{4}$	2.5100	5	4.0254
$1\frac{1}{2}$	2.7093	$5\frac{1}{2}$	4.1295
$1\frac{3}{4}$	2.8778	6	4.2247

bine these in accordance with the Talbot-Richart grading, equation 4, for a fineness modulus of 5.82.

Table III shows that the parts of the grading, 0 to $1\frac{1}{2}$ in., 0 to $\frac{7}{8}$ in. and 0 to $\frac{3}{16}$ in., have the

TABLE III. FINENESS MODULI OF GRADINGS FOR VALUES OF n AND D IN THE EQUATION $r = 1 - (s/D)^n$.
 D = maximum (square-hole) size of aggregate.

Maximum Size D (in.)	Fineness Moduli											
	Values of n											
	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	
6	7.44	7.55	7.67	7.75	7.86	7.94	8.01	8.09	8.17	8.23	8.29	
5	7.24	7.33	7.44	7.54	7.61	7.72	7.80	7.86	7.94	8.02	8.07	
$4\frac{1}{2}$	7.09	7.20	7.30	7.42	7.49	7.57	7.65	7.73	7.80	7.89	7.94	
4	6.92	7.04	7.13	7.24	7.33	7.41	7.49	7.55	7.64	7.71	7.79	
$3\frac{1}{2}$	6.73	6.82	6.94	7.04	7.11	7.21	7.31	7.37	7.44	7.50	7.58	
3	6.48	6.59	6.70	6.78	6.88	6.96	7.03	7.11	7.18	7.24	7.30	
$2\frac{1}{2}$	6.28	6.37	6.47	6.57	6.64	6.74	6.82	6.88	6.96	7.03	7.08	
$2\frac{1}{4}$	6.14	6.24	6.34	6.45	6.52	6.59	6.67	6.75	6.82	6.90	6.95	
2	5.97	6.08	6.17	6.27	6.36	6.44	6.51	6.57	6.66	6.73	6.80	
$1\frac{3}{4}$	5.78	5.87	5.98	6.08	6.14	6.24	6.33	6.39	6.46	6.52	6.59	
$1\frac{1}{2}$	5.54	5.64	5.74	5.82	5.91	5.99	6.06	6.13	6.20	6.26	6.32	
$1\frac{1}{4}$	5.34	5.42	5.52	5.61	5.68	5.77	5.85	5.91	5.98	6.05	6.10	
$1\frac{1}{2}$	5.20	5.30	5.39	5.50	5.56	5.63	5.70	5.78	5.84	5.92	5.97	
1	5.04	5.14	5.22	5.32	5.40	5.47	5.54	5.60	5.69	5.75	5.82	
$\frac{3}{8}$	4.85	4.93	5.04	5.13	5.19	5.28	5.37	5.42	5.49	5.55	5.61	
$\frac{3}{4}$	4.62	4.71	4.80	4.88	4.96	5.03	5.10	5.17	5.23	5.29	5.35	
$\frac{1}{2}$	4.42	4.50	4.59	4.67	4.74	4.82	4.89	4.95	5.02	5.08	5.13	
$\frac{1}{4}$	4.13	4.22	4.30	4.39	4.46	4.53	4.59	4.65	4.73	4.79	4.85	
$\frac{3}{16}$	3.73	3.81	3.89	3.96	4.03	4.10	4.16	4.22	4.28	4.34	4.39	
$\frac{1}{8}$	3.26	3.34	3.41	3.49	3.55	3.61	3.67	3.72	3.79	3.85	3.90	
$\frac{3}{32}$	2.88	2.95	3.01	3.07	3.14	3.20	3.25	3.30	3.36	3.41	3.46	

* s and D are square-hole sieve sizes in inches.

following fineness moduli:

Part	Job Aggregates	Fineness Modulus
0 to 1½ in.	I to IV inclusive	5.82
0 to ⅞ in.	I to III inclusive	5.13
0 to ⅜ in.	I to II inclusive	3.07

The fineness moduli and maximum size of the job aggregates are:

	Maximum Size	Fineness Modulus
No. IV	1½ in.	7.90
No. III	⅞ in.	6.80
No. II	⅜ in.	3.50
No. I	¼ in.	2.00

Employing Equation 8, the proportions of each aggregate are determined by the following procedure of calculation:

Job Course — Theoretical Total
Job Course — Theoretical Fine = proportion of fine.

$$\begin{aligned}
 & \text{(IV) (Mix)} \\
 & \frac{7.90 - 5.82}{7.90 - 5.13} = .75 \text{ of I—III; } 1.00 - .75 = .25 \text{ of IV} \\
 & \text{(IV) (I—III)} \\
 & \text{(III) (I—III)} \\
 & \frac{6.80 - 5.13}{6.80 - 3.07} = .34 \text{ of I and II; } .75 - .34 = .41 \text{ of III} \\
 & \text{(III) (I—II)} \\
 & \text{(II) (I—II)} \\
 & \frac{3.50 - 3.07}{3.50 - 2.00} = .10 \text{ of I; } .34 - .10 = .24 \text{ of II} \\
 & \text{(II) (I)} \\
 & \text{Total } 1.00
 \end{aligned}$$

The fundamental physics of mixtures expressed by equations 3 and 4, and of the fineness-modulus principle, dictate that these proportions are by absolute volume.

Absolute Volume.—The most fundamental law of mixtures of aggregates, cement and water is that *absolute volume is the basic measure of ingredients.*

This is shown by equations 3 and 4. The volume of concrete obtained from a mixture of ingredients is equal to the sum of the absolute volumes of the individual ingredients with a small plus correction for included air and minus correction for cement going into solution with the mixing water. This basis simplifies and clarifies the whole subject of the laws, physics, and technology of concrete mixtures.

Absolute volume, as used herein, is sometimes termed *apparent volume*. In the case of aggregate particles, it is the volume contained within the surfaces of the particles, including the porosity of the particles. It is the volume of water at usual temperatures about 70 deg. F. The absolute volume corresponding to 1 average cu. ft. bulk volume of standard Portland cement, one sack, or 94 lb., is 0.485 for an average apparent specific gravity of cement of 3.105. The absolute volume in a given weight of normal standard Portland cement may be determined by the equation

$$Cv = C_{lb.} / (\text{sp.gr.} \times 62.4) = C_{lb.} / 194 (\text{approx.}) \quad (9)$$

Essential Aggregate Tests.—In order accurately

to weigh out or bulk-measure the required absolute volumes, compensate for the moisture content and the absorption of the aggregates, maintain a uniform structure of gradation of sizes of aggregate particles, and obtain correct yield, strength and slump, an efficient test procedure for physical characteristics of job aggregates is essential. A coördinated test procedure and example are given briefly as follows:

Aggregate Tests	Example
A—Weigh the water, exactly filling a standard or similar container.	31.20 lb.
B—Weigh the loose-moist aggregate, filling the container.	44.34 lb.
C—Surface-dry B and weigh.	42.41 lb.
D—Dry C at 212 deg. F. and weigh.	41.61 lb.
E—Weigh D inundated, exactly filling the container with water.	56.86 lb.
R—Make a standard sieve analysis, finding the proportions of the total aggregate retained on and coarser than each of the standard sieves Nos. 100, 50, 30, 16, 8, 4, ⅜-in., ¾-in., 1½-in., etc.	

Calculations

$$d = \text{loose-moist density} = (A - E + D) / A \quad (10)$$

$$g = \text{apparent specific gravity} = D / Ad \quad (11)$$

$$a = \text{absorption by absolute volume} = (C - D) / Ad \quad (12)$$

$$m = \text{moisture by absolute volume} = (B - D) / Ad \quad (13)$$

$$w = \text{weight of moist aggregate in lb. per cu. ft. by absolute volume} = 62.4(g + m) \quad (14)$$

$$b = \text{loose-moist bulk volume corresponding to a unit absolute volume} = 1.0/d \quad (15)$$

$$f = \text{fineness modulus} = R100 + R50 + R30 + \text{etc.} \quad (16)$$

(In the example given, $d = .511$, $g = 2.61$, $a = .050$, $m = .171$, $w = 173.53$, $b = 1.975$.)

Example Characteristics of Job Aggregates.—The physical characteristics of job aggregates (shown in Table V) are assumed for the purposes of a mix calculation.

Assume that concrete is specified as follows: 2,500-lb. compressive strength at 28 days; 1½-in. maximum (square-hole) size of aggregate; and 7-in. slump.

TABLE IV. APPROXIMATE VALUES OF K_v IN EQUATIONS 3 AND 4, BASED ON THE CONTENT OF NORMAL PORTLAND CEMENT IN POUNDS PER CUBIC YARD OF SET CONCRETE

Pounds of Cement per Cu. Yd. of Concrete	Proportionate Yield of Sum of Absolute Volumes	Pounds of Cement per Cu. Yd. of Concrete	Proportionate Yield of Sum of Absolute Volumes
300	1.019	600	.981
20	1.015	20	.980
40	1.011	40	.979
60	1.008	60	.978
80	1.005	80	.977
400	1.002	700	.976
20	.999	50	.974
40	.996	800	.972
60	.993	50	.970
80	.991	900	.968
500	.989	50	.967
20	.987	1000	.966
40	.985	1100	.964
60	.983	1200	.962
80	.982	1300	.961

Table I shows the required cement content per cubic yard of concrete to be as follows:

$$\log C_{1b.} = (2,500 \times .0001701) + 2.3210 = 2.74625$$

By (1)

$$C = 558 \text{ lb.}$$

$$Cv = 558/194 = 2.88 \text{ cu. ft. absolute volume.}$$

By (9)

Equation 2 shows that the mixing water per cubic yard of concrete is

$$W = 0.0125 \times 558(4.14613 - 3.39794) = 5.22 \text{ cu. ft.}$$

By Equation 4 and Table IV, the absolute volume of aggregate is

$$Av = (27/.984) - (2.88 + 5.22) = 19.35 \text{ cu. ft.}$$

Equation 3 and Table II show the required fineness modulus of the mixed aggregate to be

$$f = 1.07(2.74625 + 2.7093) = 5.83$$

(Use 5.82, $n = .52$, Table III, as in the grading example preceding.)

Proportions by Absolute Volume.—The proportion of each aggregate is shown, in the pertinent example of grading given under *Proportioning Three or More Aggregates* (above), to be .10 of I, .24 of II, .41 of III, and .25 of IV.

The proportions by absolute volume for 1 cu.yd. of the required mix are as follows:

Materials	Calculation	Absolute Volume (cu. ft.)	
Cement	.....	2.88	(as determined)
Mixing Water	.....	5.22	(as determined)
No. I Agg.	$.10 \times 19.35 = 1.94$	1.94	= { proportion $\times$ absolute volume of aggregate
No. II Agg.	$.24 \times 19.35 = 4.64$	4.64	
No. III Agg.	$.41 \times 19.35 = 7.93$	7.93	
No. IV Agg.	$.25 \times 19.35 = 4.84$	4.84	
Total	.....	27.45	= 27/Yield

Proportions by Loose-Moist Bulk Volume.—The calculated mixing water, plus the absorption of the aggregates, minus the moisture content of the aggregates, determines the water to be added to the mix. The correction is made as follows: $5.22 - 19.35 [.10(.202 - .05) + .24(.175 - .04) + .41(.059 - .03) + .25(.020 - .02)] = 5.22 - (19.35 \times .0595) = 5.22 - 1.15 = 4.07 \text{ cu. ft. of water to be added.}$

The proportions, measuring aggregates by loose-moist bulk volume, are:

Materials	Calculation	Bulk Volume (cu. ft.)	
Cement	558/94	5.9	(sacks)
Added Water	$5.22 - 1.15 = 4.1$	4.1	(as corrected)
No. I Agg.	$.10 \times 19.35 / .515 = 3.8$	3.8	= { proportion $\times$ absolute volume of agg. divided by d .
No. II Agg.	$.24 \times 19.35 / .620 = 7.5$	7.5	
No. III Agg.	$.41 \times 19.35 / .600 = 13.2$	13.2	
No. IV Agg.	$.25 \times 19.35 / .575 = 8.4$	8.4	

Proportions by Weight.—The proportions, weighing aggregates in the natural moist condition, are:

Materials	Calculation	Weight (lb.)	
Cement	.....	558	By (1)
Added Water	$(5.22 - 1.15) \times 62.4 = 254$	254	= cu. ft. $\times 62.4$
No. I Agg.	$.10 \times 19.35 (2.64 + .202) \times 62.4 = 343$	343	= { proportion $\times$ absolute volume of agg. ($g + m$) $\times 62.4$
No. II Agg.	$.24 \times 19.35 (2.65 + .175) \times 62.4 = 819$	819	
No. III Agg.	$.41 \times 19.35 (2.66 + .059) \times 62.4 = 1,346$	1,346	
No. IV Agg.	$.25 \times 19.35 (2.67 + .020) \times 62.4 = 812$	812	
Total	.....	4,132	

Proportions by loose-dry, dry-rodded, and inundated bulk volume, and by dry weight of aggregates, may be obtained in similar manners.

Conclusion.—The foregoing physico-mathe-

TABLE V. CHARACTERISTICS OF JOB AGGREGATES.

Aggregate No.	Maximum Size (in.) D	Fineness Modulus f	Loose-Moist Density d	Apparent Specific Gravity g	Moisture by Absolute Volume m	Absorption by Absolute Volume a
I.	$1\frac{1}{8}$	2.00	.515	2.64	.202	.05
II.	$2\frac{1}{4}$	3.50	.620	2.65	.175	.04
III.	$2\frac{1}{2}$	6.80	.600	2.66	.059	.03
IV.	$1\frac{1}{2}$	7.90	.575	2.67	.020	.02

matics of materials and mixtures embody all the essentials of the calculation of mixtures specified in arbitrary ratio or otherwise.

Where accuracy in yield, strength and slump is essential, as in ready-mixed concrete production, this coordination of basic principles of mixtures is the most accurate and expedient method of mixture formulation.

A new appreciation of the fundamental measure of the physical properties of aggregates is essential to an understanding of the procedure of mix formulation. Loose-moist density, d , is the proportion of absolute volume of aggregate in the loose-moist bulk volume. Apparent specific gravity, g , is the ratio of the weight of the aggregate to the weight of the water displaced by the aggregate. Absorption, a , is the proportion of the volume of the water absorbed by the absolute volume of the aggregate. The moisture content of the aggregate, m , is the ratio of the volume of water in the aggregate to the absolute volume of the aggregate. Thus, $m - a$ is the free water in a unit absolute volume of aggregate, and $g + m$ is the moist specific gravity of the aggregate. Thus, the basis of measure of specific gravity, density, moisture content, absorption, weight per cubic foot, bulking and fineness modulus of aggregates, is the same throughout, that is, the absolute volume of the aggregate.

This use of the absolute volume, as the basic measure of characteristics of materials and proportions of mixtures, simplifies the whole subject of the physics and technology of concrete mixtures, gives simple and convenient methods of analysis and calculation, and is the only available basis of predetermination of yield, mortar content, etc. To think in terms of the absolute volume of the materials in a unit volume of mortar or concrete itself gives an advantage in making comparisons and analyzing effects. When the density of the material, as it is found by the method of measurement to be used on the work, is known, the volume by bulk measurement is the required absolute volume divided by the density. The weight of the required absolute volume is readily determined by use of the specific gravity of the material.

Absolute volume is a definite measure of materials, while weight and bulk volume are not, and it is the most practical (as well as the scientific) basis of measure in concrete-mixture formulation and analysis.

Use of the method of calculation presented is quite simple. Determination of constants A , B , a , b , d and e , in equations 1, 2 and 5, for given materials and conditions, involves a more abstruse procedure of tests and mathematical analysis of mixtures not within the scope of this article.

MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.



ED. GRUNDEMAN
President and General Manager
Blue Rapids Gravel Co., Inc.
Blue Rapids, Kan.

Coming Events

Jan. 14, 1932. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

Jan. 19-22, 1932. Pittsburgh, Pa. Annual Convention, National Crushed Stone Assn., Wm. Penn Hotel. J. R. Boyd, secretary, Merchandise Bldg., Washington, D. C.

Jan. 25-26, 1932. Pittsburgh, Pa. Annual convention, National Ready-Mixed Concrete Assn., Wm. Penn Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 27-29, 1932. Pittsburgh, Pa. Annual convention, National Sand &

Gravel Assn., Wm. Penn Hotel, V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Feb. 23-26, 1932. Wichita, Kan. Seventh Annual Southwest Road Show and School.

Feb. 23-26, 1932. Washington, D. C. Annual convention, American Concrete Institute, Wardman Park Hotel. Harvey Whipple, sec., 2970 West Grand Blvd., Detroit, Mich.

March 1-4, 1932. Washington, D. C. Twenty-eighth annual convention, American Concrete Institute. Harvey Whipple, secretary-treasurer, 2970 West Grand Blvd., Detroit, Mich.

Pumpings from the Old Pit

*Excerpts from the old files of PIT and QUARRY reveal many interesting side-
lights on the activities of the pits, quarries and plants of former days. These
are printed in this column each issue.*

Fifteen Years Ago

One of the oldest concerns in the aggregate-producing business at Des Moines, Ia.—The Coon River Sand Co.—increased its capitalization \$50,000 and started the construction of a new sand-and-gravel plant. The new operation was scheduled to have a capacity of 50 car-loads per day and capable of turning out 10 sizes of finished material. Officials of the company were G. C. Hubbell, Donald Marshall and R. Snoddy.

* * *

The Wisconsin Sand & Stone Co. reopened its quarry at Lindahl, Wis., and began producing stone to fill an important paving contract. The quarry had been purchased in 1914 from Walter L. Wood who had previously operated it for several years.

Ten Years Ago

Plans for improvements to cost about \$60,000 were in progress at the Dewey, Okla., plant of the Dewey Portland Cement Co. Contract for the execution of the work had been let to the Macdonald Engineering Co., Chicago.

* * *

A noteworthy sand-and-gravel plant began operation at Chattanooga, Tenn., when the Dixie Sand & Gravel Co. started its new producing unit, said to have cost about \$450,000. The company, a subsidiary of the Dixie Portland Cement Co., announced that capacity production of 250 tons per hr. was in prospect. Located on the Tennessee River, a short distance from the heart of the city, the plant was enabled to make quick deliveries at low transportation cost.

At the annual convention of the Illinois Concrete Aggregate Assn., the following officers were elected to serve during 1922: President, Burton H. Atwood, Interstate Sand & Gravel Co., Chicago; Vice-President, G. P. Longwell, Consumers Co., Chicago; Secretary, J. C. Brandt, Lincoln Sand & Gravel Co., Lincoln, Ill.; Executive Committee—W. G. Van Etten, H. D. Conkey & Co., Mendota, Ill.; Joseph C. Aldous, Mississippi Lime & Material Co., Alton, Ill.; S. A. Gibson, Rockford Sand & Gravel Co., Rockford, Ill.

* * *

Fire of unknown origin destroyed the plant of the New England Lime Co. at New Milford, Conn.

Five Years Ago

The National Lime & Stone Co., an important Ohio producer, acquired by consolidation the plant and assets of the National Quarries Co. and the Bluffton-Lewisburg Stone Co. General offices were moved from Carey to Findlay, O. Eight plants were to be operated under the consolidation.

* * *

New incorporations included the following: Eureka Limestone Co., Asheville, N. C.; Sand Springs Lime Co., Sand Springs, Okla.; Little Rock Stone Co., Little Rock, Ark.; Cooper Crushed Stone Co., Plymouth, Pa.; Rochester Lime & Cement Corp., Rochester, N. Y.; Illinois Silica Co., Cairo, Ill.

* * *

The National Slate Assn. had completed plans for the holding of its annual convention January 18 and 19 at the Hotel Commodore, New York, N. Y. N. M. Male was president of

the association and was to preside at the sessions.

* * *

Sand and gravel, dredged from the bed of the Big Arkansas River, at Wichita, Kan., was being merchandised in that area by a new producing concern, the Weaver-Blank Sand & Gravel Co. Officers included R. W. Weaver, D. E. Weaver, and F. E. Blank.

New Corporations

MASSMAN-PETERMAN Co., Kansas City, Mo. Henry J. Massman, Jr., 1222 W. 62nd St. and others. To operate stone quarries.

BANKS LIME & MINERAL PRODUCTS Co., Boise, Idaho. \$50,000. A. R. Masters, president and general manager. John Marchetti, superintendent.

H. M. SPAHR LIME & STONE PRODUCTS Co., Spahr, Md. 1,000 sh. pref. @ \$100; 1,000 sh. com. n.p.v. Harry M. Spahr, Edward D. Shriner, Jr., Albert S. Brown.

ONTARIO SAND & GRAVEL Co., Geneva, N. Y. Increased capital stock from 3,500 to 7,000 shares, of which 4,000 are pref. @ \$25 and 3,000 com. n.p.v.

DU PAGE SAND & GRAVEL Co., Winfield, Ill. 2,000 sh. n.p.v. T. E. Fiske, H. H. Cites and W. H. Velde.

READER SAND & GRAVEL Co., Minneapolis, Minn. \$50,000. S. J. Reader, 2143 St. Clair St., St. Paul, Minn.; C. F. Clark and William F. Fitzgerald, Minneapolis, Minn.

AMULCO ASPHALT Co., Houston, Tex. \$25,000. John H. Wynne, 2410 Clebourne St., and associates.

METROPOLITAN CONCRETE CORP., Newark, N. J. \$500,000 pref. and 400,000 sh. n.p.v. Henry A. Siebrecht, New Rochelle, N. Y.; Thomas Graham and Thomas C. Meadows, New York, N. Y.

CAROLINA KAOLIN CORP., Spruce Pine, N. C. \$10,000. H. D. Marmon and S. K. Mortimer, Pinwola, N. C.; C. R. Ricker, Spruce Pine, N. C.

STERLING CONCRETE CORP., New York, N. Y. \$5,000. H. W. Feder, 2 Lafayette St.

SOUTHERN SILICA Co., Etowah, Tenn. \$500,000. E. M. Sheller, John Reed, Oran L. Reed, John D. Parks, J. B. Casper.

CLEVELAND SLAG Co., Youngstown, O. 1,000-sh. n.p.v. Franklin B. Powers, Hugh W. Manchester, M. S. Wilkinson.

Georgia Marble Company Opens Offices on Coast

The Georgia Marble Co., with headquarters in Tate, Ga., and plants near Nelson, Marietta and Tate, recently established Pacific Coast headquarters at 605 Market St., San Francisco, Cal. Howard Seidell is manager of the new office.

Personal Mention

Samuel Blackman, employed in the plant of the Alpha Portland Cement Co. near Syracuse, N. Y., was saved from almost certain death recently by fellow employees after he had been buried under a pile of bulk cement in the storage building at the plant.

Daniel Catlin, attorney and member of the board of directors of the Missouri Portland Cement Co., has been elected a member of the board of control of the Art Museum of the City of St. Louis.

Arthur Ewell, 21, of Greenport, N. Y., was seriously injured recently when he was run down by a locomotive in the quarry of the Lone Star Cement Co. plant at Hudson, N. Y. Mr. Ewell's left foot was badly crushed in the accident.

Homer H. Hadley, district engineer in charge of the Seattle office of the Portland Cement Assn., recently addressed the Associated Engineers of Spokane at its weekly luncheon at the Hotel Davenport.

Daniel B. Miller has been named managing engineer, in charge of activities on the Pacific Coast by The Asphalt Institute. Offices have been opened by Mr. Miller at 206 Sansome St., San Francisco. **B. E. Gray**, highway engineer at the main offices of the institute in New York, is now in San Francisco where, with Mr. Miller, he is organizing the work of the Pacific Coast Division and coordinating it with that of the main office. Mr. Miller is well known on the Pacific Coast where, since 1923, he has been associated in an engineering advisory capacity with several of the larger surety companies operating in this territory. He is also prominent in military circles in connection with his duties as a lieutenant colonel of the U. S. Army Infantry Reserve. For the six years prior to his military services he was connected with the asphalt industry at Washington, D. C.

Fred Miick has recently been appointed engineer in charge of sewage-treatment-plant equipment sold in the Pacific Coast territory of Link-Belt Co., Pacific Division, San Francisco. Transferred from the Philadelphia plant of Link-Belt, where he was in the engineering and sales departments for twenty-one years, Mr. Miick brings to the coast a broad knowledge of sewage works engineering and design.

W. S. Gilbreath, Detroit, one of Michigan's pioneers in the development of good roads, was honored recently at a testimonial dinner in Detroit, attended by more than 300 good-roads enthusiasts of the Middle West.



W. J. Koehring.

W. J. Koehring has been made president of the National Equipment Corp., of which he had been vice-president since its organization. Mr. Koehring succeeds his late brother Philip, who met his death recently. W. J. Koehring has been identified with the equipment industry since 1906 when he with his brother Philip and Richard Kiel organized the Koehring Machine Co. Until this recent change he was president and works manager of the Koehring division and president of the T. L. Smith division of the National Equipment Corp. He is a director of the Sterling Motor Truck Co. and of the Mid-City State Bank, Milwaukee.

J. R. Bakstad has been named president and general manager of the



J. R. Bakstad.

Pierce Equipment Corp., Chicago, Ill., recently organized to take over the international sale and distribution of the line of light rollers, known as the "Three Bears," manufactured by the Pierce Governor Co. of Anderson, Ind. Mr. Bakstad is well known in the construction equipment field and to equipment distributors, having devoted more than fifteen years to the manufacture, engineering and sale of road-building and construction equipment.

Alfred W. Gauger, for five years head of the division of mines and department of chemical engineering at the University of North Dakota, has joined Pennsylvania State College to become head of the mineral industries experiment station.

John V. N. Dorr, president of The Dorr Co., New York, N. Y., has been elected president of the American Institute of Chemical Engineers for the coming year. Mr. Dorr has been the recipient of numerous previous honors for his fundamental early work on chemical engineering equipment, of which his present company has been the outcome.

Obituary

Donald Fraser, director and former vice-president of Chain Belt Co., died recently at the age of 78 years. Mr. Fraser, formerly engaged in the pattern-making business in Minneapolis and Milwaukee, came to the Chain Belt Co. in 1895. He was active in the early developments of the company, contributing many important inventions to the chain business. He subsequently became vice-president and works manager, retired in 1917, and was made a Director of the Company. He was also a Director of the Sivyer Steel Casting Co. and the Federal Malleable Co., both of Milwaukee.

Joseph Uhlman, safety director of the Pennsylvania Dixie Cement Corp. plant at Richard City, Tenn., died on December 8. He had been with the company and its predecessor, the Dixie Portland Cement Co., for 23 years and previously had been employed by the Wolverine Portland Cement Co. and the Peerless Portland Cement Co. at their plants in Michigan. By training Mr. Uhlman was a mill-wright, later serving as repair foreman and stock-room foreman. His ability and interest in the accident-prevention movement made him well-known throughout the cement industry. He was one of the pioneer safety directors and constantly contributed valuable ideas through this work.

Traffic News and Comment

Examiners' Reports

Cement.—Examiner Horace W. Johnson proposes that the Commission find the rates on cement, plaster and related articles from Portland and Boettcher, Colo., Hanover and Trident, Mont., to Buffalo, Wyo., not unreasonable or unduly prejudicial in the past, but unreasonable for the future to the extent they may exceed the rates to Clearmont, Wyo., by more than 11 c. on cement and by more than 14½ c. on plaster and related articles. I. C. C. Docket No. 24,339, Colorado Portland Cement Co., et al. v. A. T. & S. F. et al.

Magnesite.—Examiner Leland F. James proposes that the Commission find the rate on three carloads of imported calcined magnesite, in bags, from Brooklyn, N. Y., to Memphis, Tenn., unreasonable but not unduly prejudicial in the past, to the extent it exceeded 63 c. c.l. min. wt. 40,000 lb. He proposes reparation amounting to \$314.00. I. C. C. Docket No. 24-521, Memphis Freight Bureau et al. v. Pennsylvania et al.

Rate-Committee Dockets

New England Freight Assn.

Lime.—Carriers propose to reduce the rates on lime, c. l. min. wt. 40,000 lb., from Brunswick, Me., by establishing a proportional rate of 23 c. from that point to destinations in Trunk Line territory taking Buffalo, Erie, Philadelphia and Pittsburgh bases of class rates. The sixth-class rate now applies. Docket No. 23,987.

Trunk Line Assn.

Amiesite.—It is proposed to establish the Birdsboro scale plus 10 c. for single-line hauls and plus 30 c. for joint hauls throughout Trunk Line territory for application on crushed stone or slag, coated with oil, tar or asphaltum. Bulletin 702.

Crushed Stone.—Carriers propose to increase the rate on crushed stone¹, from Suffern, N. Y., to Passaic Jct., Rochelle Park, Maywood, Lodi, Hackensack and Bogota, N. J., from 60 c. to 80 c. per net ton. Docket No. 23-214.

Cement.—To eliminate fourth-section departures, carriers propose to increase the rate on cement from Binnewater, N. J., to Sayre, Pa., from 15 c. to 15½ c. per 100 lb. Docket No. 28,249.

Lime.—To clarify tariffs to the extent of confining application of rates to the commodities for which they were intended, carriers propose to amend present commodity description on lime to read, "Lime, common, hydrated, quick or slacked, viz., building, agricultural or chemical." This description is to apply from Akron, Oakfield, Wheatville, Clarence Centre,

Transit, Syracuse and Dover Plains, N. Y., and other points to destinations in Trunk Line and New England territories. It does not affect the rates. Docket No. 28,274.

A proposal similar to the above to apply from East Buffalo and Buffalo, N. Y., is being considered in Docket No. 28,288, and from Avis, Pa., in Docket No. 28,287.

Sand and Gravel.—To meet motor-truck competition, shippers propose a reduction in the rate on common sand and gravel¹, from Portland, Pa., to Stroudsburg or East Stroudsburg, Pa., from 70 c. to 50 c. per net ton. Docket No. 28,212.

Slag.—To meet motor-truck competition, carriers propose to reduce the rate on commercial crushed slag¹, from Scottdale, Pa., to White Bridge, Pa., from 70 c. to 60 c. per net ton. Docket No. 28,236.

Central Freight Assn.

Public Hearings.—The public-hearing dates for the year 1932 before the C. F. A. general committee and C. F. A. auxiliary committee jointly on subjects docketed by the Central Freight Assn., will be as follows: Jan. 12; Feb. 9; Mar. 15; Apr. 12; May 17; June 14; July 12; Aug. 16; Sept. 13; Oct. 11; Nov. 15; and Dec. 13. The only exception to the above dates is that public hearings dealing with rates on common sand and gravel, crushed stone and similar road-building materials will be held before the C. F. A. Special Road-Building-Material Committee at the regular meeting of said committee, which will be held on Wednesday, the day following the general public hearing dates listed above. Items of general interest to producers in the nonmetallic-minerals industry which are docketed for consideration by the C. F. A. will appear regularly in this department of PIT AND QUARRY.

Sand and Gravel.—Shippers at Ashtabula, O., have proposed reduced rates to destinations in Ohio, Pennsylvania and West Virginia, on common sand and gravel in open-top cars. A few representative rates are shown below. Docket No. 30,036.

To	Miles	Proposed	Present
New Lyme, O.	20	\$0.60	\$0.80
Walford, Pa.	80	.90	1.05
New Castle, Pa.	82	1.00	1.05
Snodes, O.	72	.95	1.10
Pittsburgh, Pa.	125	1.20	1.60
Canton, O.	66	1.05	1.20
Wheeling, W. Va.	160	1.30	....
Powhatan, O.	178	1.45	....
Bessemer, Pa.	137	1.20	1.60

Dolomite.—Carriers propose to revise commodity description in agency and/or individual lines' tariffs publishing rates on crude or raw dolomite and fluxing stone, carloads, between points in C. F. A. territory, also from points in C. F. A. territory to points east of the Western Termini of Eastern Trunk Lines, to read as follows:

"Stone, dolomite or fluxing, furnace or foundry, raw or crude (unburnt)." Said rates to be restricted to apply only on shipments when loaded in open top cars. Docket No. 29,997.

EDITOR'S NOTE.—This proposal to restrict the application of raw dolomite rates to open-top cars follows closely upon the decision of the Interstate Commerce Commission in I. & S. Docket No. 3-571, reported in PIT & QUARRY, Dec. 2, page 75, and Dec. 16, page 16, in which the Commission decided that the carriers had not justified their schedules restricting the rates so as to apply to shipments in open-top cars only.

Lime.—Carriers propose to reduce the rates on lime, c. l. min. wt. 30,000 lb., from Mitchell, Ind., to Freeport, Ill., to 15 ½ c.; to Rockford and Dixon, Ill., to 15 c.; to LaSalle and Galesburg, Ill., to 14½ c.; and to Champaign, Ill., to 12 c. per 100 lb. Docket No. 30,071.

Western Trunk Line Committee

Calcite.—The privilege of stopping, partly to unload at intermediate stations in Iowa and South Dakota, is requested by shippers of calcite at Springdale, Mont. They propose to amend Item 1,784 of Trans-Continental Tariff 14-V to make this provision at a charge of \$6.30 per stop. Docket No. 7,775.

Sand and Gravel.—Shippers are asking that the rate on sand and gravel¹, from Valley and Fremont, Neb., to Omaha and South Omaha, Neb., be reduced from 60 c. to 45 c. per net ton. Docket No. 2,161-A.

Southern Freight Assn.

Crushed Stone, Sand, Gravel and Slag.—Carriers propose to establish main-line or trunk-line basis of rates on sand, gravel, slag, stone and chert, to, from and between stations on the Laurinburg and Southern R. R. Docket No. 56,326.

Feldspar.—Shippers propose to amend Docket No. 56,179, to provide the same rates to Bethewan, Ind., as proposed to Marion, Ind. (PIT AND QUARRY, Dec. 30.) Docket No. 56-179, Sup. 1.

Lime.—Carriers propose to publish a rate of \$3.48 a net ton on fluxing lime, having no commercial value for building or chemical purposes, c. l. min. wt. 60,000 lb., from Sherwood, Tenn., to Middletown, O. Docket No. 56,398.

At the request of shippers for reduced rates, carriers have suggested a rate of \$2.10 per net ton on fluxing lime, c. l. min. wt. 60,000 lb., from Pine Hill, Ky., to Ashland, Ky., the same as in effect from Ohio kilns. Docket No. 56,428.

Mica.—Shippers propose a reduction in the rate on mica scrap or waste

from Penland and Spruce Pine, N. C., to Newark, N. J., from 68 c. (sixth class) to 30 c. per 100 lb., c. l. min. wt. 30,000 lb. Docket No. 56,446.

A reduction in the rate on crude cr scrap mica, c. l. min. wt. 30,000 lb., from Martinsville, Va., to Rutherford, N. J., to 42 c. per 100 lb. Docket No. 56,450.

Sand and Gravel.—Carriers propose to amend distance scales shown in Sec. 2 of Agent Glenn's Tariff 108 (Florida Sand and Gravel Tariff) so as not to apply from points on the Southern Ry. north of Lynchburg, Va., to destinations on the A. C. L., S. A. L. and F. E. C., and other Florida lines connecting with these lines. Docket No. 56,335.

Talc.—At the request of shippers for reduced rate, carriers have suggested reducing the rate on crude or ground talc, c. l. min. wt. 50,000 lb., from Hemp and Glendon, N. C., to Miami, Fla., from \$18.36 to \$8.11 a net ton. Docket No. 56,332.

Southwestern Freight Bureau

Cement.—Shippers are asking for the establishment of rates on cement, c. l. min. wt. 50,000 lb., from Spocari, Ala., and other points named on page 9, S. W. L. Tariff 94, to points in Texas on the P. & S. F. Ry., west and south of San Angelo, Tex., based on the Col. 3 scale of distance rates shown in Item 110 of the tariff.

It is proposed to establish rates on cement, c. l. min. wt. 50,000 lb., from Speed, Ind., to points in Missouri south of the Missouri River, on basis of same mileage scale and formula as apply from Linwood, Ia., as prescribed by the Commission in I. C. C. Docket No. 21,492, which is the I. C. C. Docket 8,182 Scale II. This is a shippers' proposal. Docket No. 23,918.

Gypsum.—Shippers propose the establishment of a rate of 24 c. per 100 lb., on gypsum rock and gypsite, mine-run or crushed (not ground),¹ from Cement, Gladys, Ideal and Southard, Okla., to Tuscacosa, Ala. Docket No. 23,868.

Sulphur.—Carriers propose to establish at Texarkana, Ark.-Tex., and St. Louis, Mo., the same rates and refining in transit arrangements on sulphur (brimstone), crude and refined, description and min. wt. as per S. W. L. Tariff 102-N, from Barba, La., to all points to which rates, under jurisdiction of the S. W. F. B., are published in Tariff 102-N, as in effect from Bryanmound, Freeport, Newgulf Jct., and other Texas points shown in Item 65. A deposit of sulphur has recently been discovered in the Parish of Vermillion at a point about six miles north of Erath, La. An application has been filed with the I. C. C. to construct a branch line from Erath to Barba, La., which is the name of the station that will serve the new sulphur mine. Docket No. 23,922.

¹ The carload-minimum weight will be 90 per cent. of the marked capacity of the car except when car is loaded to full cubical or visible capacity, actual weight will apply.

Practical vs. Physical or Chemical Properties

As the first step in a study of the dependence of the technical properties of concrete in practice on the physical and chemical properties of the cement, experiments reported here began with investigations of hardened cement. The properties concerned with setting in water are regarded as the most important physical-chemical properties of the cement and the results obtained in previously reported investigations have been utilized. Customary methods of measurement in connection with compressive and tensile strength were employed in testing specimens of hardened cement with known set. Special methods of measurement of modulus of elasticity, shrinkage and permeability were tried.

The results of the investigations show that empirical relations between all of the practical properties investigated and the various properties connected with the setting phenomenon can be determined—relations which seem to be independent of such properties of the cement as chemical com-

position, age and water-content. The ratios concerned are: (1.) compressive strength and per cent. in volume in solid phase; (2.) tensile strength and per cent. by volume in solid phase; (3.) modulus of elasticity and per cent. by volume in solid phase; (4.) shrinkage and per cent. by volume of the loose setting-water, calculated to total water minus the volume of the free water; (5.) permeability and the sum of the per cent. by volume of setting-water and free water. Apparent mathematic formulae with tentatively calculated constants are derived for the first three of the relations enumerated.

The well-known relation between compressive strength and the water-cement ratio is found to represent a special case of the relation between compressive strength and per cent. by volume in solid phase found in these investigations. An empirical relation, which is expressed in a mathematical formula, was found between modulus of elasticity, compressive strength and tensile strength.—Dipl.-Ing. Donovan Werner and Stig Giertz-Hedstrom in *Zement* 20:984-987 and 1000-1006, Nov. 12 and Nov. 19, 1931.

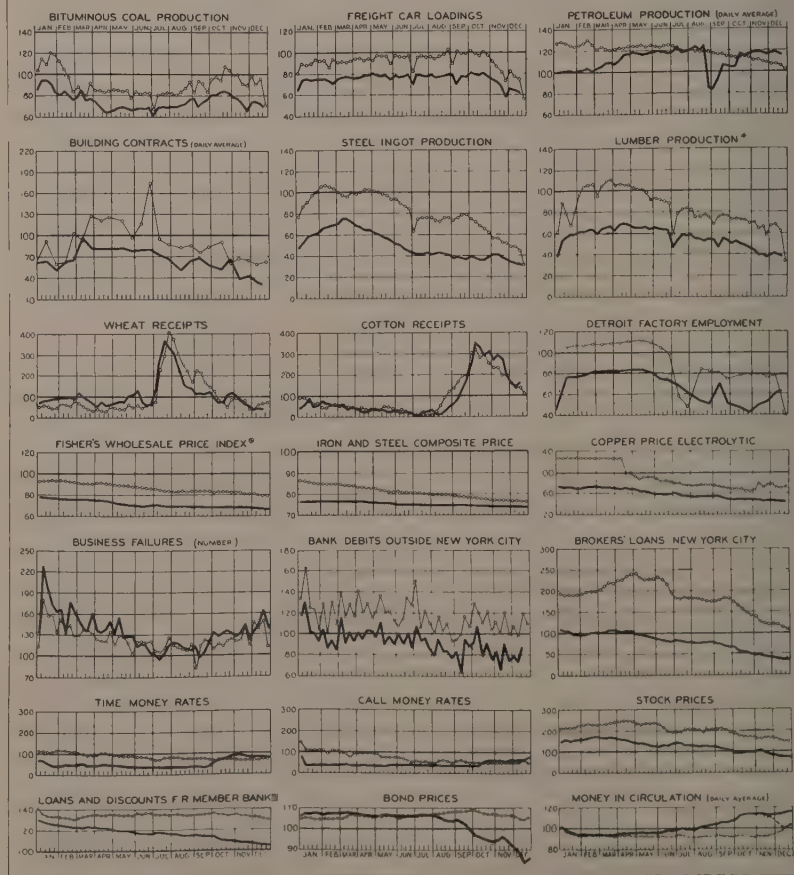
WEEKLY BUSINESS INDICATORS

SURVEY OF CURRENT BUSINESS
UNITED STATES DEPARTMENT OF COMMERCE

DATA PLOTTED, WHERE AVAILABLE FOR YEAR ENDING DECEMBER 31, 1931

WEEKLY AVERAGE, 1923-1925, INCLUSIVE-100

LEGEND
1930
1931



*RELATION TO WEEKLY AVERAGES 1926-1930 PER WEEK SHOWN

•RELATIVE TO 1924-100

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, for which no responsibility in any way is to attach to this magazine or to any of its staff.

U. S. Gypsum Co. Earned About \$2 a Share in '31

Although the major portion of United States Gypsum Company's business is largely dependent on residential building construction, the percentage recession in sales in 1931 has been less than that of new building contract awards, reflecting to some extent a better maintained demand for gypsum in repair work and remodeling. In addition, certain miscellaneous specialties—added from time to time to diversify concern original gypsum lines—are being sold in increasing volume. Active development of new products by a strong research organization, together with extension of markets and lowering of costs, indicate that earnings recovery with any revival of building activities probably will be more pronounced than for the average building materials concern. Operations in 1931 were necessarily sharply curtailed, but the company has demonstrated its ability to earn a fair profit in each month.

Based on results through October last, indications are that full year net will approximate \$2 a common share, compared with \$4.15 recorded in 1930.

California Aggregates Firm Being Refinanced

Re-financing plans for the bond and debenture obligations of Pacific Coast Aggregates, Inc., of San Francisco, Cal., are now in progress. A committee headed by Livingston B. Keplinger, official of Bancamerica Co. and a director of Pacific Coast Aggregates, is working out details of the reorganization and they are to be announced shortly.

Although no definite word as to the form that the refinancing is to take was forthcoming from officials of the company or representatives of the

committee, it is reported that formation of a protective committee representing the bond and debenture holders is in contemplation.

Pacific Coast Aggregates, as of January 2, 1931, had outstanding \$3,976,000 in first mortgage 6½ per cent. sinking fund gold bonds, and \$1,476,000 in ten-year sinking fund 7 per cent. convertible debentures. Annual interest charges on the basis of that face value of the securities amount to \$361,760.

Minimum sinking fund requirements for the bonds in 1931 amounted to \$50,000, and in 1932 will reach \$100,000. The same requirement applies to the debentures.

Good Liquid Position Is Maintained by G. L. & A.

Despite the fact that earnings of Gypsum, Lime and Alabastine, Ltd., Canada, are on a lower scale this year, it is reported that the company still maintains a good liquid position and owes no money to the banks. At the end of last year bank loans totaled \$35,000. The reduction in the company's sales and earnings has been reflected in dividends on the common stock which are now paid at the rate of 40 c. a share per year. Payments at the beginning of the year were made at the rate of 80 c. annually but this rate was reduced by half in October of 1931.

Dolomite Products Has Best Year in History

Dolomite Products Co., Inc., of Rochester, N. Y., has just paid an \$8 dividend on the preferred stock and a \$1 dividend on the common stock. The company completed the best year in its history in 1931, according to John H. Odenbach, president and general manager, and produced 500,000

tons of stone at the two stone plants in Gates and Penfield, N. Y., and 125,000 tons of sand at its sand and gravel plant in Penfield.

Dolomite Products Co., Inc., had a modest beginning ten years ago and now represents a capital investment of more than \$2,000,000. Mr. Odenbach stated that orders booked for next year, or in prospect, indicate that 1932 will exceed even this year, and plans are being made accordingly. Matthew P. Odenbach is vice-president of the company, Frank J. Waddell is secretary and Harvey N. Clarke is general superintendent.

Marquette Cement's 1931 Shipments Hold Up Well

The Marquette Cement Manufacturing Co. reports that shipments in November were approximately 20 per cent. above those for the same month last year and, according to Robert B. Dickinson, vice-president and general manager, December business equalled, if not exceeded, that of November in tonnage volume.

Mr. Dickinson reports that the eleven months of this year, ended November 30, showed a volume equal to that for the same period in 1930. The company has made heavy shipments on contracts for government work along the Mississippi River, as well as on the contract to supply the cement for the new Chicago post office.

Chicago Producers See More Promising Outlook

The cement, sand, gravel and crushed-stone producer in the Chicago district report the business outlook brighter for 1932, due to the expected large highway programs and bridge and other concrete projects, according to a recent survey made by the Chicago Journal of Commerce.

CURRENT DIVIDENDS

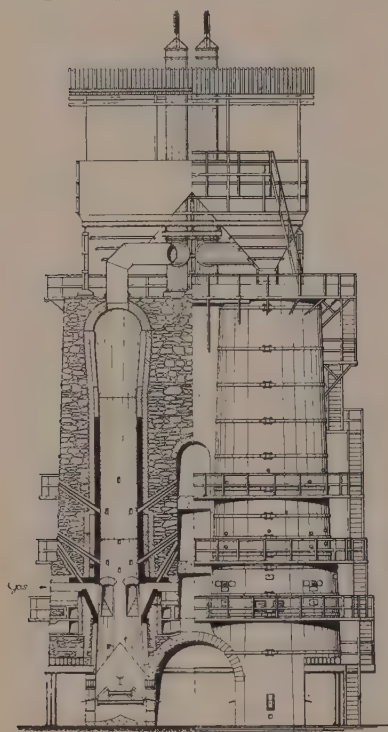
COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE	COMPANY	CLASS OF STOCK	DIVIDEND RATE	HOLDERS OF RECORD	PAYABLE
Alpha Portland Cement.....	Preferred	\$1.75 qr.	Dec. 1	Dec. 15	McWilliams Dredging.....	Common	\$0.37½ qr.	Nov. 15	Dec. 1
Alpha Portland Cement.....	Common	\$0.25 qr.	Jan. 2	Jan. 25	Monolith Portland Cement.....	Preferred	\$0.40 S.A.	.....	Jan. 2
American Aggregates.....	Preferred	\$1.75 qr.	Dec. 21	Jan. 1	.....	Common	\$0.40 S.A.	.....	Jan. 2
Arundel Corp.....	Common	\$0.75 qr.	Dec. 21	Jan. 2	National Gypsum Co.....	Preferred	\$1.75 qr.	Dec. 15	Jan. 2
Boston Sand & Gravel.....	Preferred	\$0.87½ qr.	Dec. 22	Jan. 2	New York Trap Rock.....	Preferred	\$1.75 qr.	Dec. 21	Jan. 2
Boston Sand & Gravel.....	Common	\$0.15 qr.	Dec. 22	Jan. 2	Pacific Portland Cement.....	Preferred	\$1.62½ qr.	Dec. 31	Jan. 5
Calaveras Cement.....	Preferred	\$1.75 qr.	Dec. 31	Jan. 15	Pennsylvania Glass Sand.....	Preferred	\$1.75 qr.	Dec. 16	Jan. 1
Canada Cement Co.....	Preferred	\$1.62½ qr.	Nov. 30	Dec. 31	Pittsburgh Plate Glass.....	Common	\$0.25 qr.	Dec. 10	Dec. 31
Cleveland Quarries Co.....	Common	\$0.25 qr.	Nov. 10	Dec. 1	Raybestos-Manhattan.....	Common	\$0.40 qr.	Nov. 30	Dec. 15
Dolese & Shepard.....	Common	\$1.00 qr.	Dec. 21	Jan. 2	Republic Portland Cement.....	Preferred	\$1.75 qr.	Nov. 23	Dec. 1
Giant Portland Cement.....	Preferred	\$1.75 S.A.	.....	Dec. 15	Santa Cruz Portland Cement.....	Common	\$2.00	Dec. 21	Dec. 24
Ideal Cement.....	Common	\$0.50 qr.	Dec. 15	Jan. 2	.....	Preferred	\$2.50 qr.	.....	Jan. 1
International Amiesite.....	Preferred	\$1.75 qr.	Nov. 20	Jan. 1	Southwestern Portland Cement.....	Common	\$1.50 qr.	.....	Jan. 1
International Cement.....	Common	\$0.75 qr.	Dec. 15	Dec. 31	Superior Portland Cement.....	Class A	\$0.27½ M	Dec. 23	Jan. 1
International Salt.....	Common	\$0.75 qr.	Dec. 15	Jan. 2	Superior Portland Cement.....	Class B	\$0.25 Sp.	Dec. 12	Dec. 21
Johns-Manville.....	Common	\$0.25 qr.	Dec. 26	Jan. 16	Texas Gulf Sulphur.....	Common	\$0.75 qr.	Dec. 1	Dec. 15
Kelley Island Lime & Transport.....	Common	\$0.25 qr.	Dec. 24	Jan. 1	United States Gypsum.....	Common	\$0.40 qr.	Dec. 15	Dec. 31
Kentucky Rock Asphalt.....	Preferred	\$1.75 qr.	Dec. 10	Jan. 2	United States Gypsum.....	Preferred	\$1.75 qr.	Dec. 15	Dec. 31
Lehigh Portland Cement.....	Preferred	\$1.75 qr.	Dec. 14	Jan. 2	Warner Co.....	1st Pfd.	\$1.75 qr.	Dec. 15	Jan. 1
Leslie-California Salt.....	Common	\$0.20 qr.	Dec. 1	Dec. 15	Warner Co.....	2nd Pfd.	\$1.75 qr.	Dec. 15	Jan. 1
Medusa Portland Cement.....	Preferred	\$1.50 qr.	Dec. 25	Jan. 1	Worcester Salt.....	Common	\$1.25 qr.	Dec. 24	Jan. 2

Review of Foreign Practice

Firing Lime Kilns with Commercial Type of Gas

The firing of industrial kilns with gas has not been adopted as widely as its advantages would justify. The reasons probably lie in the fact that considerable capital is required for the installation of generators and purifiers. The advantages of gas firing, however, are that gas can easily be adapted to the heat required at any time, that fuel is saved and capacity increased, that no storage of coal is required, that labor is reduced and hygienic conditions improved, and that in the case of lime or magnesite, there is no injurious mixture of ashes.

The Rheinische Kalksteinwerke has converted its lime shaft kilns, originally operated on producer gas, for firing with purchased commercial gas,



Gas-fired shaft lime kiln.

and as the original generators were too small to enable the kilns to attain their fullest capacity, there has been a considerable increase in output—from 60 to 65 metric tons per kiln in 24 hr. The six kilns are built according to the Müller system (German patent 346,565) and have oval section. The tubes for the flames are so distributed over the section of the kiln that two tubes are provided on each long side and two more diagonally on each of the narrow sides, giving a uniform burning. The burning is so thorough that never more than 3 per cent. of the product is unsuitable. The gas consumption per ton

(metric) of burned lime, when the CaCO_3 content of the raw stone is 95 to 97 per cent., 213 cu. me. of commercial gas of 4,000-kilocalories minimum value. This corresponds to a heat consumption of 852 kilocalories per kg. of calcined lime, and the efficiency accordingly is 75 to 80 per cent. With the original producer firing the gas consumption per metric ton of burned lime was 785 cubic meters of 1,100 to 1,200 kilocalories.

The use of commercial gas is of all the more interest in that the lines of the German producers are being extended so that gas is more generally available.—*Tonindustrie-Zeitung* 55:1263-1264, Nov. 12, 1931.

Small Plants Succeed in Making High-Test Cement

The differences between the products of large, and small or medium-sized cement plants, often depend not on any intrinsic merit of one or the other but on such factors as lack of expert technical assistance or lack of adequate working capital in the smaller plants. Experience of the author shows that high-strength cement is by no means a monopoly of the larger plants. In general, the relatively higher first costs of a small plant are offset by higher administrative expenses of the larger ones. Two small plants bearing out these ideas are a small plant of only 18 to 20 metric tons per 24 hours, built for the construction of a dam in the Spanish Pyrenees and described in *Revista de Obras Publicas* in 1929, and the Xeulley plant in France, which is analyzed in detail in this article. The Xeulley plant, operating by the rather unusual "double-burning" process (that is, using quicklime instead of limestone; a process employed also at two plants in the department of Ardeche and several plants in Belgium), uses one rotary kiln 45 m. long and 2 m. in diameter, with widened calcining zone of 2.3 m. (147 by 6.5 by 7.5 ft.), and produces a cement testing 30 to 32 kg. per sq. cm. in 1:3 standard plastic-mortar tests at three days, 32 to 35 kg. at seven days and 40 to 45 kg. at 28 days.—E. Leduc in *Le Ciment* 36:401-414, Nov., 1931.

Super Cements Produced in Europe 50 Years Ago

Recent discussions of the history of the high-test special cements cause the writer to point out that there was a "high-early-strength" cement in Germany much earlier than has yet been suggested, and that in Württemberg, which has the reputation of being the home of the earliest concrete arch bridges. About 1880 the cement plants at Blaubeuren, Ehingen and

Schelklingen in Upper Swabia, which were later included in the Portland-Zementwerken Heidelberg-Mannheim-Stuttgart A. G., began the production of a special cement based on standard Portland, but with exceptionally careful preparation of selected, well-burned clinker and thorough fine grinding. After thorough laboratory and experimental tests in practice, the new cement was used in various large arches and comprehensive observations made on it. The results were so good that it was put on the market as "bridge cement." While Portland cement at that time had a remainder of 5 per cent. on the 900-mesh-per-sq. cm. screen and 20 to 25 per cent. on the 4900-mesh screen, the "bridge cement" had a residue of 0 per cent. on the first and 10 to 12 per cent. on the latter sieve. It was used in a number of important bridges between 1893 and 1903. However, the manufacture of the cement was not continued because it was naturally more expensive than Portland, and the cement and concrete industries in general had not yet progressed beyond the point where Portland was sufficient.—Prof. Dr.-Ing. A. Kleinlogel in *Zement* 20:921-922, Oct. 15, 1931.

Developments in Cement Plants in Scandinavia

The Norresundby Portland-Cement-fabrik A.-S., Norresundby, near Aalborg, Denmark, which was founded by the exporting and shipping firm A.-S. Ostasiatisk Co., Copenhagen, has recently been sold, along with its ground holdings, to the Danish company, F. L. Smidth & Co. A.-S. of Copenhagen. The plant is capitalized at 1,250,000 crowns and has a yearly capacity of over 800,000 bbl. The Norresundby plant operates only for export and will continue to use the selling organization of the Ostasiatisk Co.

Skanska Cement A.-B., Malmö, Sweden, put a new plant into operation at the middle of September at Hallekis, with a yearly capacity of approximately 500,000 bbl. This plant has one rotary kiln 94 meters (308 ft.) long, the largest in Sweden. The plant was erected at a cost of roughly 2,500,000 crowns.

The plant of the Dalen Portland Cementfabrik A.-S., Brevik, Norway, suspended operation at the beginning of September with filled storage. The domestic demand has been unusually low because of the five-month lock-out in many industries, which only ended about the middle of September, and export conditions have been exceptionally difficult so that there was no chance for export to make up for the falling-off of domestic demand.—*Tonindustrie-Zeitung* 55:1230, Nov. 2, 1931.

Recent Patents

AMERICAN

Cement

Process of producing cement. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Mfg. Co., same place. No. 1,834,963.

Crushing

Gyratory crusher. Richard Bernhard, Allentown, Pa., assignor to Traylor Engineering & Mfg. Co., same place. No. 1,837,102.

Lime

Operation of lime and dolomite kilns and furnaces. Rudolf Clement, Cologne-Braunsfeld, and Walther Voss, Cologne-Klettenberg, Germany. No. 1,836,526.

Materials Handling

Automatic control for skip buckets. William W. Sayers, Chicago, Ill., assignor to Link-Belt Co., same place. No. 1,835,094.

Boom-point sheave assembly. Leslie A. Russell, Milwaukee, Wis., assignor to Koehring Co., same place. No. 1,836,281.

Bucket tripper for steam shovels, dredges, or the like. La Mont V. Trimmer, Middle Valley, and Floyd R. Krial, Springtown, N. J. No. 1,837,081.

Mining Machinery

Mining apparatus. Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,836,250.

Mining apparatus. Charles F. Osgood, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,836,277.

FOREIGN

Cement and Concrete

Manufacture of cement. W. W. Triggs (Eddystone Cement Corp.). British 361,901.

Means for producing watertight cement and mortar masses. Bernard Heimann, Datteln, Westfalia. German 540,253.

Process for accelerating the hardening of hydraulic cementing materials. Chemische Fabrik Grünau Landshoff & Meyer Akt.-Ges., Berlin-Grünau. German 541,162.

Crushing and Grinding

Vibratory ball mills. C. N. G. Wilde. British 361,992.

Devices in roller-and-breast mills for regulating the grinding space. O. Soder. British 362,159.

Grinding-apparatus. T. Klein. British 362,327.

Device for regulating the pressure of the roller in crushing-roller mills. Dr.-Ing. Otto Moog, Braunschweig. German 540,287.

Horizontally-divided crushing jaw. Karl Heinz Lochter, Semmelwitz, Silesia. German 540,427.

Ball mills with grinding balls moving in vertical plane. K. & Th. Möller G. m. b. H. and Heinrich Bartmer,

Brackwede, Westfalia. German 540,495.

Trommel mill. Clifford Osgood Bartley, Denver, Colo. German 540,289.

Process and apparatus for operation of tube mills with pneumatic separation and material-circulation between mill and separator. Deutsche Babcock & Wilcox Dampfkessel-Werke Akt.-Ges., Oberhausen, Rhineland. German 540,290.

Tube or ball mill. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 540,291.

Centrifugal grinding mill. Eksploatacja Wyzalazkow Spolka z. Ograniczona Odp. Wiedzialnoscia, Warsaw, Poland. German 540,975.

Ball mill. Edward William Green and George Rodham, Unthank, London. German 540,733.

Grinding installation. Deutsche Babcock & Wilcox Dampfkessel-Werke Akt.-Ges., Oberhausen, Rhineland, and Ludwig Kollbohm, Hagen, Westfalia. German 540,734.

Drying

Drying-apparatus. S. Diesen. British 362,680.

Apparatus for drying materials. Simplicity System Co., assignee of Lawrence B. West and Marion P. Wall, Chattanooga, Tenn. Canadian 318,323.

Excavating

Dredgers. Felten & Guillaume Carlswerk Akt.-Ges. British 362,154.

Excavator tooth. Leshner W. Van Buskirk, Easton, Pa. Canadian 318,018.

Dipper tooth. Paul Herve Desrosiers, assignee of John A. Critchley and Ernest G. Jones, Joliette, and Snow Freeman MacDougald, Valleyfield, Que. Canadian 318,153.

Kilns

Rotary kilns. E. Ronne. British 362,361.

Processes of burning material, and apparatus therefor. A. Andreas. British 362,517.

Process for the operation of rotary kilns for calcining gypsum and similar materials, and rotary kiln therefor. Mussat Binot & Cie., Gagny, Seine-et-Oise, France. German 541,140.

Material-Handling

Conveyor systems. J. B. Webb. British 361,955.

Grabs. D. J. Barnard. British 362,163.

Grabs for bulk materials. Naamlooze Vennootschap Havenbedrijf Vlaardingen-Oost. British 362,205.

Jigger conveyor. E. Ridgill. British 362,264.

Cranes. C. Cohen-Venezian. British 362,275.

Conveying, loading or like machines. British Jeffrey-Diamond, Ltd. (Jeffrey Manufacturing Co.). British 362,492.

Belt and like conveyors. Head, Wrightson & Co., Ltd., J. M. Ringquist and W. I. Wrightson. British 362,456.

Cleaning device, particularly for cleaning belt conveyors. A. W. Mackensen G. m. b. H., Magdeburg. German 540,191.

Chain conveyor for bulk materials. "Miag" Mühlenbau und Industrie Akt.-Ges., Braunschweig. German 540,255.

Bearing and shaking conveyor. Flottmann Akt.-Ges., Herne, Westfalia. German 540,665.

Apparatus for unloading bins. J. Pohlig Akt.-Ges., Köln-Zollstock. German 540,666.

Pulverized-material feeder. Foster-Wheeler Corp., New York, N. Y., assignee of Martin Frisch, Bronx. Canadian 318,062.

Crane. Cleveland Crane & Engineering Co., Wickliffe, assignee of Earl T. Bennington, Cleveland Heights, Ohio. Canadian 318,264.

Mixing

Truck concrete mixers. G. Jaeger and J. Eggert. British 362,350.

Concrete-mixing machines. T. Wagener. British 362,824.

Concrete Mixer and Agitator. Chain Belt Co., Milwaukee, Wis., assignee of Charles Field Ball. Canadian 318,053.

Sacking

Holders for bags or sacks. A. J. Biggs and A. L. Lott. British 362,706.

Bag-filling machine. St. Regis Paper Co., assignee of The Bates International Bag Co., New York, assignee of John Russell, Sydney, N. S. W., Australia. Canadian 318,110 and 318,111.

Screening and Separating

Magnetic separating-apparatus. General Electric Co., Ltd., and J. B. Cramer. British 362,124.

Separation of dry materials. I. L. Bramwell and Birtley Co., Ltd. British 362,341.

Vibrating screen for sifting broken, crushed or finely-divided material. C. W. G. Barton. British 362,620.

Dust-collector operating on centrifugal force. Theodor Fröhlich Akt.-Ges., Berlin. German 540,292.

Dust-collecting apparatus. Ernst Curt Loesche, Berlin-Lankwitz. German 541,116.

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New Machinery and Supplies in 1931

IN presenting a review of new machinery and other equipment during an entire year it is, of course, impossible to mention everything that has come on the market in the last 12 months. Some of the outstanding developments, however, are described briefly on the following pages. They will, perhaps, serve as a cross-section of the advances which have been made by some of the many manufacturers who are striving constantly to bring out such equipment as will improve and economize the cost of production.

Drilling

An All-Steel Well Drill.

The new Keystone well drill introduced during the year offers several novel features. Engineers, contractors, well drillers and quarry men have frequently expressed a need for a light, but powerful and efficient well drill. The all-steel, strongly riveted frame of the Keystone No. 70, will be acceptable where wood construction has been found susceptible to destructive action of weather, insects, etc.

The machine, exclusive of derrick and tools can be conveniently packed in one box, approximately ten feet long, four feet wide and six feet high, and weighing about 5,000 lb. This eliminates the "knocking down" for shipment necessary with larger units, as well as the reconstruction of the outfit at port of destination.

The Keystone No. 70 has a 16 hp., 4-cyl. Waukesha engine, producing ample power and drives through two internal expanding clutches on a countershaft, to the rope drum and the drilling crank. Ball bearings are used on drilling crank. All main shafts are 2½ in. in diameter, which is oversize for the short span between bearings



Keystone well drill showing telescoping derrick.

characteristic of this compactly built machine.

The telescoping pipe derrick, which is 30 ft. high extended, is a novel feature. It offers unusual strength and rigidity at low cost.

Improved Blast-Hole Drill.

Designed especially for blast-hole work, the improved No. 44 Loomis



The improved Loomis Clipper blast-hole drill.

Clipper drill, manufactured by the Loomis Machine Co., Tiffin, O., found favor with scores of quarry operators in 1931.

The No. 44 drill is made with either wood or steel frame and can be supplied with crawlers, both front and rear, or with crawler rear wheels and regular front wheels. Electric, gasoline or steam power is available. This improved drilling machine is intended primarily to drill blast holes up to 8 in. in diameter, with either manila or wire line to the maximum depth for blast-hole work. It is, however, capable of drilling as deep as 1,100 ft. and deeper, using all or part wire rope.

The drill is noted for its ease and quickness of operation, as well as its efficient spudding stroke. The loose crank is a patented feature, starting and stopping the tools instantly by simply pushing a lever. The band-friction clutch on the drilling crank is a lined metal band having a single-nut adjustment. The clutch can be easily relined if necessary, and is quick to respond and efficient in any weather. A patented rope-saving device located in the rear end of the spudding beam tends to eliminate the burning of the

cable at the point where it leaves the drum.

Light-weight Sharpener.

The new DS-2 Gardner-Denver sharpener is the ideal small drill-steel sharpener for quarries using hand drills. The machine is operated with two die pistons in tandem. Both are used for clamping and upsetting. One piston only is used for fullering and gauging. This improved design results in unusually low air consumption and longer life.

A single throttle valve controls the fullering, clamping, and dolly operations. This lever is conveniently placed at the side of the machine, and its movement is so smooth and easy that there is little or no fatigue for the operator.

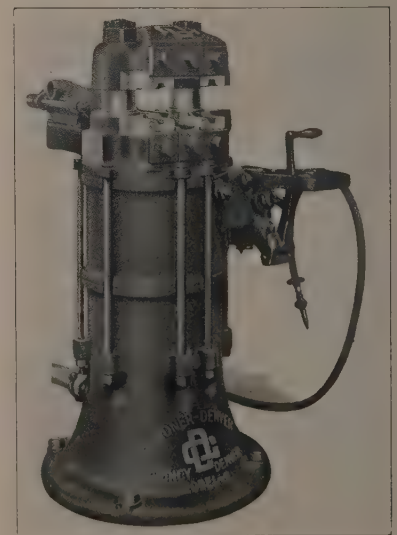
This sharpener, the bare weight of which is 1,370 lb., is designed to handle steel in cross section up to 1½ in. and to make bits having a maximum diameter of 2½ in. Standard four-point cross bits, six point bits, and McLellan-type bits are made with regular equipment.

A New Core Drill.

The Longyear BD scout drill was brought out in 1931 to meet the need for a core drill of moderate capacity and light weight. Because of these features, it is particularly adapted for economical and rapid prospecting when exploring new areas. In an operating property, it is equally valuable for blocking out stone and keeping reserves in proper relation to production.

The scout drill weighs 1,350 lb. and consists of drill, hoist and Novo gasoline engine, all mounted as a single unit. It will recover core from ¾ to 3½ in. in diameter.

The drill is chain driven. Angle



Gardner-Denver drill sharpener.

holes may be drilled by shortening the braces to the head and taking the proper number of links from the drive chain. It is important to note that the hoist is equally effective for angle holes as it is for vertical holes, being lined up with the sheave at all times.



Cleveland sinker drill.

The swivel head mounting is such that the head may be easily and quickly swung aside and away from the hole, providing an unusually generous amount of working space.

Balance Is Keynote.

The Star Drilling Machine Co., Akron, O., during the year placed on the market the No. 41 Speed-Star drilling machine, incorporating many new features of design and construction.

The No. 41 Speed-Star is of all steel construction, with frame of special design and electric welded. Double-crank-drive balances the drilling load on the frame, and with spudder drive, mast and bull reel lined up with center of frame, side strain is eliminated. Balance is the keynote of the No. 41 design. Parts subject to strain or wear are of steel, insuring many years of service with minimum repair expense.

The Speed-Star will drill with either wire line or manila cable. Either gasoline or electric power can be furnished. It is available in non-tractor type illustrated, as a tractor with round wheels or crawler treads, or for mounting on truck.

The No. 41 Speed-Star is an ideal size for blast-hole work as it will easily swing a 4 1/4 in. by 20 ft. stem with

5%, 6 or 8 in. bits. It will easily drill to a depth of 500 ft.

A New Sinker.

The H77 sinker drill introduced by the Cleveland Rock Drill Co. is an outstanding example of the ultra-modern in rock-drill design. Its construction involves features which represent the very latest thought, but which at the same time, have had thorough test before being accepted. Like other Cleveland models, the H77 is all-drop-forged.

Complying with popular demand, the throttle of this sinker was located in the back head, where it is convenient to the operator's right hand. The throttle handle has a half-speed position, in addition to the regular on and off positions, and this is a convenience when starting a hole. The air connection is on the opposite side, and is of the swiveling type.

The blowing valve also is located within easy reach of the right hand, and it is so designed as to be automatically retained in either blowing or running position without the operator's holding it. When the wing lever is turned outwardly from the machine a copious stream of live air is conveyed down through the hollow of the drill steel, effectively cleaning out wet or dry cuttings, and greatly aiding in attaining high cutting speed.

Excavating Equipment

Bucyrus-Erie Developments.

Bucyrus-Erie has pushed its development work during 1931 to the limit. A large number of completely new machines along with many improvements in older models are the result. Increased yardage with reduced operating expense has been the keynote in designing this new and complete line.

Early in January the company introduced a new 3 cu.yd. Diesel drag-line, a machine of medium size with full air control and the ability to move with extreme ease and safety across soft ground.

A little later was announced the purchase by the Bucyrus-Erie Co. of a controlling interest in the Monaghan Manufacturing Corp. of Chicago, manufacturers of walking drag-line excavators. Following this the company took over the "Loadmaster"—a portable gasoline crane with a full revolving boom.

In the spring of the year four new convertible excavators were announced. These machines are all closely similar; the difference being one of size. Each one is available with gasoline, Diesel or electric power. Two new quarry shovels were introduced, the 52-B machine 2 1/4-cu.yd. electric machine and the 42-B electric—a 1 1/4-cu.yd. machine. These two shovels are constructed for use as drag-lines, clam-shells or lifting cranes, but they are designed primarily for use in small and medium size quarries.

Two of the most unusual developments of the year were a counterbalanced hoist for stripping shovels and aluminum booms for dragline excavators.

Improved Crawlers and Drive.

The Speeder Machinery Corp., Cedar Rapids, Ia., pioneer manufacturers of full-revolving, fully-convertible light gasoline shovels, announced a great improvement in the crawlers and driving mechanism of the Speeder Model B3 of 1/2-cu. yd. capacity.

The new type crawlers and driving mechanism are designed especially to eliminate friction and to expedite the repair and adjustment of the traction shaft while on the job. The new crawlers are of the lug-driven type, 16 in. in width, and are hinged by three eyes. A roller idler replaces the idler sprocket on the front of the crawlers. All crawler-carrier trunnions and return rollers are bronze bushed. The traction shaft is splined and no keys are used. It is supported by four heavy bronze-bushed split bearings, and is three separate shafts rather than one long shaft, as this allows the man on the job to quickly remove any part for adjustment or repair. The travel gears are machine-cut, case-hardened, and run in grease.



The Bucyrus-Erie 37-B convertible excavator.



The improved Kiesler clam-shell bucket.

The Speeder Whirlwind of $\frac{3}{8}$ -cu.yd. capacity, the Speeder 90 of $1\frac{1}{4}$ -cu.yd. capacity, and the Speeder B3 of $\frac{1}{2}$ -cu.yd. capacity are now equipped with crawlers and crawling mechanism of the same type.

Clam-Shell Bucket Improved.

The new type N clam-shell bucket announced by the Jos. F. Kiesler Co., 928 W. Huron St., Chicago, during 1931, is improved in design and construction, employing many of the well-known Kiesler features, to which have been added the redesigned double-fulcrum digging arms, shells, cutting edges, and teeth. A feature of this bucket is the correct design which enables it to penetrate freely and dump sticky materials quickly. There are no obstructions on the inside of the shells. All parts are built extra heavy for continuous service and long life. No dead weight is built into the bucket.

Gasoline-Type Excavator.

The Marion Steam Shovel Co., Marion, O., has announced through its district offices and representatives in various parts of the world, a new $\frac{1}{2}$ -cu.yd. shovel, dragline, clamshell and crane, named Type 120.

The new Type 120 is a gasoline-operated machine designed for small general excavating and material-handling work.

"This new model," states J. H. Watters, president of The Marion Steam Shovel Co., "is constructed with the same engineering thought, the same quality of material and the same workmanship characteristic of all other Marions from the famous $1\frac{1}{4}$ -cu. yd. gas or Diesel-electric to our largest machines. And it will be sold and serviced by our regular Marion organization."

Alloy-Steel Construction.

An improved, full-revolving 1-cu.yd. excavator known as the P&H Model 500, was announced by Harnischfeger Corp., Milwaukee, Wis. This machine, which spent last winter working in the test field, was put into production during the summer.

The Model 500 follows the general P&H design with a number of added refinements. Main frames are unit-alloy steel castings. Wearing parts are of alloy heat-treated steels. Drums

are in tandem and operate through the P&H power-clutch control. A minimum number of gear reductions makes this new machine extremely simple. Sturdy gasoline, Diesel, or electric motors provide ample power whether the machine is used as shovel, drag-line,



The P&H 1-cu.yd. excavator.

crane, clam-shell, hoe, or as a skimmer.

Corduroy (crawler) frames are cast from alloy steel and are bolted directly to the car body. The crawlers employ the P&H double-sprocket drive directly engaging the link pins. Twelve pairs of alloy heat-treated rollers distribute the weight of the machine through the corduroy shoes to the ground. Corduroy shoes of various widths can be provided to meet different ground conditions.

Unit Cast-Steel Design.

Link-Belt Co., Chicago, Ill., announced the addition of a new shovel-crane-dragline, known as the K-48, to its line which ranges from $\frac{3}{4}$ - to $2\frac{1}{2}$ -cu.yd. capacity.

The Link-Belt K-48 is an all purpose unit serving as a shovel, a crane, a trench hoe or a drag-line. It can be furnished with any or all of the attachments which are usually only available on smaller machines. The K-48 is arranged for gasoline engine, Diesel engine, or electric-motor drive. The gasoline engine has a heavy-duty 130 hp. rating and the Diesel engine or electric motor is of corresponding capacity. As a shovel, it is equipped with a 25 ft. boom, 17 ft. 6 in. dipper stick, and a $1\frac{1}{4}$ -cu.yd. dipper.

Its unusual ease of convertibility is a feature because it reduces the owner's investment in equipment to a minimum, without limiting the range of work possible, and enables him to use this machine to the best and fullest advantage.

Other features include large, slow-wearing crawler rollers; self-cleaning



The new Marion $\frac{1}{2}$ -cu.yd. gasoline-shovel.

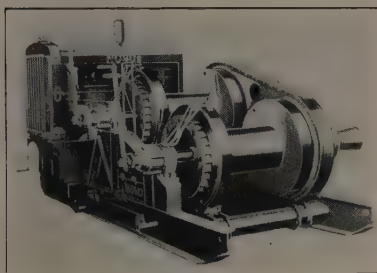


The Link Belt K-48 shovel in operation.

crawler treads; large ring gear and roller path; unit-cast-steel construction throughout; and large drums, clutches and brakes.

Slack-Line Excavator Hoist.

A heavy-duty, anti-friction hoist introduced by the Novo Engine Co., Lansing, Mich., in 1931, is built in sizes of 1 cu.yd. capacity up to 3 cu.yd. for drag-line scraper service. The front or inhaul drum has a line speed of 200 ft. per min., while the rear or outhaul drum travels at three times this speed, or 600 ft. per min.



Novo excavator hoist.

Every bearing is of the anti-friction type, roller bearings being used on the drum and intermediate shaft bearings. The drum unspools on roller bearings and a roller thrust bearing is used on each screw thrust. The frame is constructed of welded structural steel welded integral with the base. The power units are 75 to 125 hp. gasoline engines or electric motors.

This hoist is also arranged for slack-line cableway work with two speeds on the front drum—200 ft. per min. for digging and 600 ft. per min. for inhaul. These hoists have a quadruple roller chain drive, double-cone friction, and a one-piece adjustable brake giving 280 deg. of braking surface.

Quarry Cars

Large Bottom-Dump Type.

The new 4-door, 8-wheel Whopper automatic dump car was perhaps the most outstanding development during the year of Sanford-Day Iron Works, Inc., of Knoxville, Tenn.

The capacities of this car range

from 10 to 100 tons and with the larger opening for the doors in the bottom of the car and the new improved latch lever to hold the doors securely when closed, this car is said to be most ideal and economical for power-shovel loading and the transportation of ores, stone, coal, slag, clay, muck, etc.

The car can be made in track gauges from 36 in. up to standard railroad gauge, and can be equipped with standard railroad couplings and air brakes.

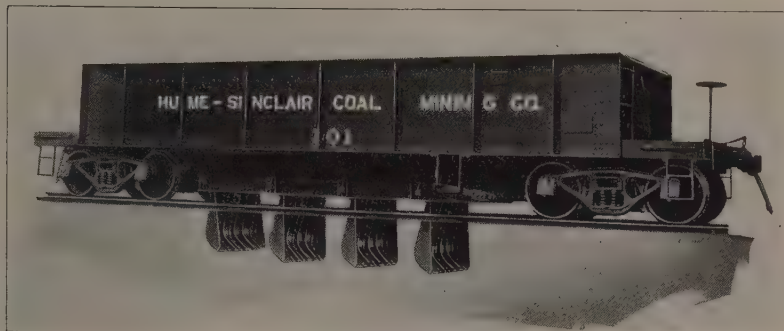
Woodford Accomplishments.

The outstanding achievement of the Woodford Engineering Co. during 1931 was the adoption of the large

Woodford haulage system, a new and complete signal system. The track layout is divided into signal blocks and signal lights in the tower show where all cars are at all times. One or two cars to a block are indicated. This signal system is applicable also to train operation.

New Air-Dump Car.

The Western Wheeled Scraper Co., Aurora, Ill., developed a new air-dump car that departs radically from ordinary standards. It is a drop-door car, end-dump, and has a capacity of 20 cu. yd., level-full measure. It is dumped by air and there is ample dumping power at customary pressures for dump car operation.



Whopper automatic dump car.

double-track drop-door air-dump car to its system of remote-controlled electric railway.

Each car is equipped with heavy-duty street railway motors and complete electrical apparatus to enable the car to operate continuously over 6 per cent. grades and to be controlled entirely from the control towers and shovels.

An installation of these cars was made in Spain to handle a heavy stripping job where the depth of overburden is 154 ft. and the waste dump over 100 ft. high. The use of a continuous 6 per cent. grade has made possible the confining of the entire operation into a very small area.

During the past year also, there has been perfected by the engineering department and placed in use with the

So large an end dump car operated by air was thought impossible until those pioneer builders of dump cars designed and put such a car into successful quarry service.

It is built on standard-gauge track and rides the track well. It is simple in design, short-coupled and compact, and is strongly built for quarry and mining service. In dumping, the end door moves down to act as an apron or chute, while the forward end of the car bed is pushed up by air cylinders to a steep discharge angle.

An end-dump car of such great capacity and strength can be put to a multitude of uses—for example, stockpiling rock or ore, extending a fill without expensive trestle work, squaring off dumps and many others.



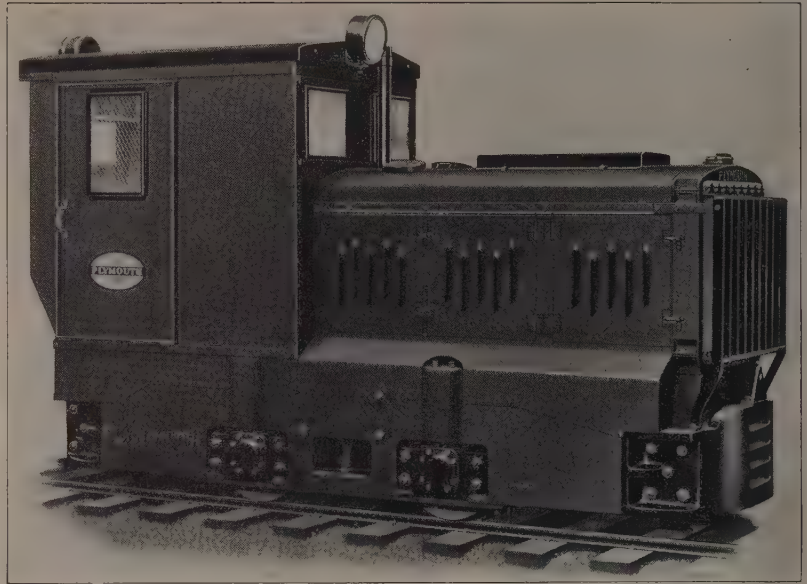
New Woodford remote-controlled car.

Locomotives

Industrial Steam Type.

The Vulcan Iron Works of Wilkes-Barre, Pa., developed a new type of locomotive, said to be the first of its kind built in America. The new design meets the demand for a comparatively heavy steam locomotive, distributing the weight over a greater length of rail and a greater number of ties, making it easier on track upkeep and especially adaptable to all conditions involving the handling of heavy loads on steep grades with sharp and kinky curves on poorly-laid track.

The locomotive illustrated weighs 55 tons in full service order, with the weight properly distributed over eight driving wheels. The 8-wheel arrangement consists of two four-wheel swiveling trucks, each having a pair of 13-in. by 16-in. piston-valve-type cylinders, with valves controlled by Walschaert gear. Each truck is a complete unit in itself and obtains its steam through flexible connections from the boiler. Driving wheels are



Plymouth 6-ton Diesel locomotive.



Vulcan steam locomotive for heavy service.

36 in. in diameter, the truck wheel-base 5 ft., and the total wheel-base 26 ft. 5 in. The length of the locomotive over bumpers is 32 ft. 6 in.

An Oil-Electric Model.

In addition to the great increase in hauling power, the Heisler oil-electric locomotive offers other worthwhile economies. It burns only \$2.50 to \$3.50 worth of fuel oil in a day, to do the same work for which a steam switching locomotive burns \$20 to \$30 worth of coal per day. Further, due to the fact that the oil-electric locomotive is smokeless, it is especially desirable for use in the near cities. Another saving is in labor, as only an engineer is needed to operate it, no fireman being required.

The construction employed in the new locomotive permits the electrical equipment to develop greatly increased tractive effort at its hourly and continuous ratings.

Two 180-hp Buda Diesel engines deliver their power to two Westinghouse D.C. generators which, in turn, supply the current to two traction motors mounted underneath a Commonwealth integral cast-steel frame. The trac-

tion motors are spur-gearred to a center drive shaft which transmits the

power through a pair of bevel gears to one axle of each truck. By means of side rods the power is delivered to the other driving wheels. The driving gears are surrounded by Timken roller bearings.

A Ford-Powered Unit.

The Brookville Locomotive Co. of Brookville, Pa., was among the manufacturers who, in 1931, introduced locomotives using a Ford Model AA power plant. The chassis, running gear and all other parts on the Brookville model are guaranteed against breakage or failure due to inferior parts, faulty workmanship or ordinary wear for a period of six months; with the exception of injury by accident or misuse. The power plant and all other parts manufactured by the Ford Motor Co. are known to be reliable



Brookville Ford-engine-powered locomotive.

and can always be inexpensively serviced by Ford dealers.

Dual-spring-journal wheel suspension permits use over rough, crooked tracks. Steel tires provide 25-per cent. greater traction. A four-speed reverse, providing four speeds in either direction, up to 16 miles per hour, employs high-grade spiral bevel gears, Timken bearings are used and operate under an oil bath in a dust-proof housing.

The locomotives are offered in 2, 2½, 3, 3½ and 4-tons weight for any gauge of track.

New Plymouth Diesel.

The Fate-Root-Heath Co., (Plymouth Locomotive Works), Plymouth, O., again showed its confidence in the use of Diesel-powered locomotives and the early return of prosperity by adding three new models of Diesel locomotives to its already extensive line. They are known as Model FLD 6-ton equipped with a 3-cyl. 36 hp. engine; DLD 8-ton equipped with a 4-cyl. 48 hp. engine, and DLD 10-ton equipped with a 6-cyl. 72-hp. engine.

These locomotives are equipped with Cummins Diesel engines similar to the one that made the remarkable 500 mile non-stop run on the Indianapolis Speedway May 30, 1931, at an average speed of 86 mi. per hr. and a fuel cost of \$1.78.

Another remarkable record was the coast-to-coast trip of a truck which weighed 16,000 lb. powered by a Cummins Diesel engine. This truck traveled 3,214 miles in 97 hr. 20 min. at a fuel cost of \$11.22.

The first Model FLD 6-ton Plymouth locomotive has been in service for several months with a large lumber company where it is making Diesel history hauling 778 loaded cars and 229 empty cars in 65 hr. at a total fuel cost of \$2.00, or 25 c. per 8-hr. day.

Plymouth Diesel locomotives are available in all sizes from 6 to 80 tons making it possible for practically any haulage problem to be solved.

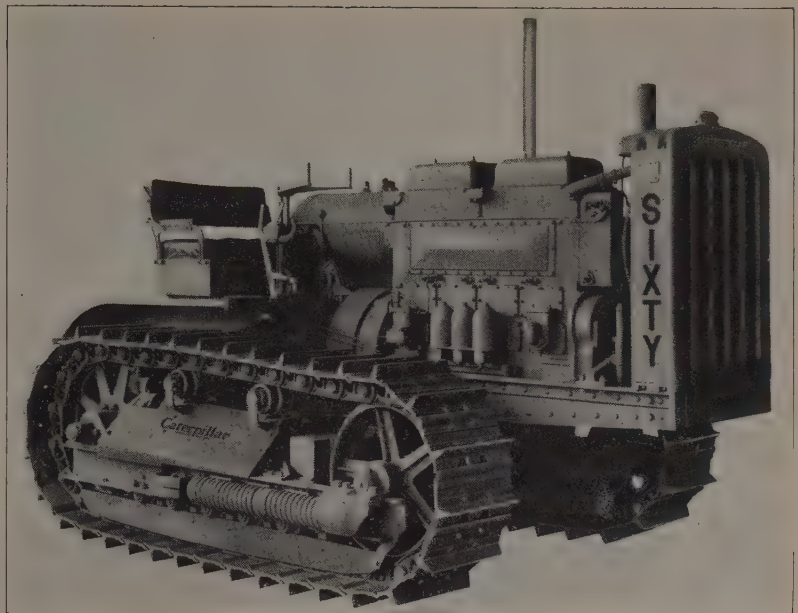
In addition to building a complete line of Diesel locomotives, the Fate-Root-Heath Co. also developed a line of gas-electric and oil-electric locomotives from 25 to 80 tons in weight.

Tractors

New Caterpillar Diesel.

A Caterpillar Diesel Sixty tractor was the Caterpillar Tractor Company's answer to a plea for a Caterpillar tractor plus the ability to operate on Diesel fuels.

Caterpillar-designed and Caterpillar-built, the Diesel engine was developed as a power plant especially for the Sixty tractor. Power, traction, transmission, frame—all are coordinated in correct balance. In accomplishing this, certain changes in the design of various parts other than the engine have also been made. Frame side members of the Diesel



The new Caterpillar Diesel-powered tractor.

Sixty differ from the Standard Sixty. Radiator design is modified. A heavy equalizer spring is used instead of an equalizer bar. Tracks are of 34 sections; recoil springs are tandem type.

In the Caterpillar Diesel Sixty the fuel injection apparatus is Bosch equipment, adapted to Caterpillar requirements. An important contribution by Caterpillar Tractor Co. in the building of this engine and its presentation to the public is the introduction of sealed fuel injection apparatus. Supplied with each tractor is an extra set of fuel pumps and nozzles—adjusted, sealed and interchangeable as units—avoiding any necessity for field adjustments to the fuel injection system. Should a fuel pump or nozzle ever require adjustment in the field, one of these units may be quickly substituted and the troublesome one returned to the Caterpillar Tractor Co. for servicing.

The Diesel Sixty develops sixty-three maximum drawbar horsepower and seventy-five maximum belt horsepower. Its shipping weight is approximately 25,000 lb.

The Diesel engine is started by a small two-cylinder Caterpillar engine, compactly mounted on the left side of the main power unit.

The Diesel Sixty tractor is the only Diesel-powered model in the Caterpillar line—it is an addition to the line and does not displace the standard Sixty, powered by gasoline engine.

Gravity-Dump Tractor.

An automatic gravity tractor dump wagon, called the Camel, was introduced by the Shunk Manufacturing Co., Bucyrus, O. Pit and quarry operators are finding a wide use for haulage units of this kind and the Camel seems to fill the bill.

The machine, illustrated here, combines the salient features of the truck,

tractor, trailer and bulldozer. Its large capacity, combined with an inherent ability to operate successfully regardless of weather or haulage conditions, enables it to move much greater yardage than is possible with teams, trucks, or trailers.

The nose of the Camel may be converted into a bulldozer; the draw-bar attached to the heavy auxiliary axle in the rear may be used for general draw-bar work.

The bulldozer, an outstanding feature, is built substantially for severe punishment and designed to bulldoze, grade, level and backfill. It is recommended for use with tracks.

An important feature of the Camel's design is its heavy auxiliary axle of high-carbon steel, fitted with Timken bearings, which carries the full load of the tractor, frame and payload, thus relieving the driving axle of all strains from load carrying and allowing the full power of the tractor to be realized in moving the vehicle.

A Hydraulic Bulldozer.

One of the 1931 additions to the lines of the Foote Bros. Gear & Machine Co., Chicago, Ill., was the Bates hydraulic bulldozer built especially for use in combination with Bates crawler-type tractors.

In addition to having unusual simplified design and exceptional sturdiness, all of the operating mechanism is located below the level of the seat, giving clear vision of the operator.

The oil pump is easily started or stopped by throwing the small clutch lever located below the driver's seat. When in operation, the control of the oil pressure in the hydraulic ram raises or lowers the blade of the bulldozer in two to four seconds time, depending on the blade clearance.

A three-way valve controls the oil supply. One position of the valve

handle forces the oil in at one end of the cylinder and lowers the blade. In another position it forces the oil in at the opposite end of the cylinder and raises the blade. The neutral position by-passes the oil back to the tank and holds the blade of the machine at any height desired.

The bulldozer is built with a heavy frame with exceptional ground clearance, and so attached that it does not interfere with the normal operation of the tractor. This frame is bolted on to the crawler frame at back of the tractor and the lifting mechanism is attached to the tractor frame just behind the engine.

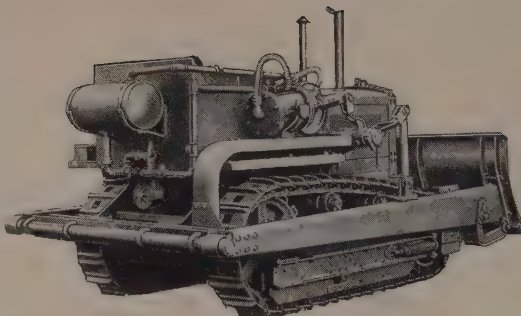
The major portion of the weight of the bulldozer is carried in the blade with the pivot point at the rear of the frame. The action of the lifting mechanism located half way between the pivot point and the blade on the bulldozer frame throws all the weight to the front and holds the tractor and the bulldozer blade into the ground.

Trailers and Wagons

Tractor Dump Wagon.

A number of improvements were incorporated in the Ohio tractor dump wagon, manufactured by the Ohio Locomotive Crane Co. of Bucyrus, O.

The Ohio crawler-type wagon, recognized as outstanding in design and construction, is recommended for short hauls where the character of the soil does not permit the use of wheels. The crawler assembly is of the rigid rail type with tracks that oscillate over dead axle, allowing full traction for the shoes regardless of any rough or uneven ground conditions.



The Bates bulldozer and tractor.

Exhaustive tests in the field under actual operating conditions have proven the importance of our extensive use of alloy steel and heat-treated parts, giving long life under severe duty. The track shoes are made of a special composition manganese steel. The pins and bushings are made of alloy steel, case-hardened and ground. Five double-flanged rollers rotating on the inside track insure distribution of load. Large diameter heat-treated steel shafts and Hyatt roller bearings with wedged-type dust seals eliminate the usual bearing troubles.

The steering position is arranged with dual controls within easy reach, allowing the operator to face the load or power unit. The body is gravity-balanced and operated with foot controls from the steering position. The body automatically locks on return to the loading position. With the body at a 90-deg. angle, or unloading position, it can be used very effectively as a bulldozer for leveling loads and back filling.

Two New Dump Wagons.

The new 8 cu.-yd. Euclid track-wheel gravity rear-end dump wagon was presented to meet the long existing need

for a heavy-duty wagon. It is particularly constructed for working under a shovel and for hauling rock, dirt, clay, sand or shale.

The body is constructed of steel of special analysis to resist the abrasive action of sand, gravel and stone. A carbon steel reinforcing plate is located upon the bottom of the body for protection against heavy rocks. Alloy steel castings at the corners of the rear body opening eliminate the possibility of rocks or other material warping the sides out of shape.

It features a rear gate allowing full 8-cu. yd.-capacity loads and is so arranged to raise upward at a steep angle, freeing the material at the start of the dumping and permitting ample space for discharging all loads. When hauling extremely large rocks this gate can easily be removed, leaving the rear end open for easy discharge. In cases where a driver does not get close enough to fill, he can use the wagon as a bulldozer to push the material over the fill.

A new hydraulic bottom-dump



Euclid gravity rear-dump wagon.

wagon was also placed on the market during 1931 by Euclid. The tractor driver has complete control of dumping and door-closing operations from his driving position. No manual effort is required at the dump, as all door motions are operated hydraulically by means of a lever conveniently located at the driver's seat.

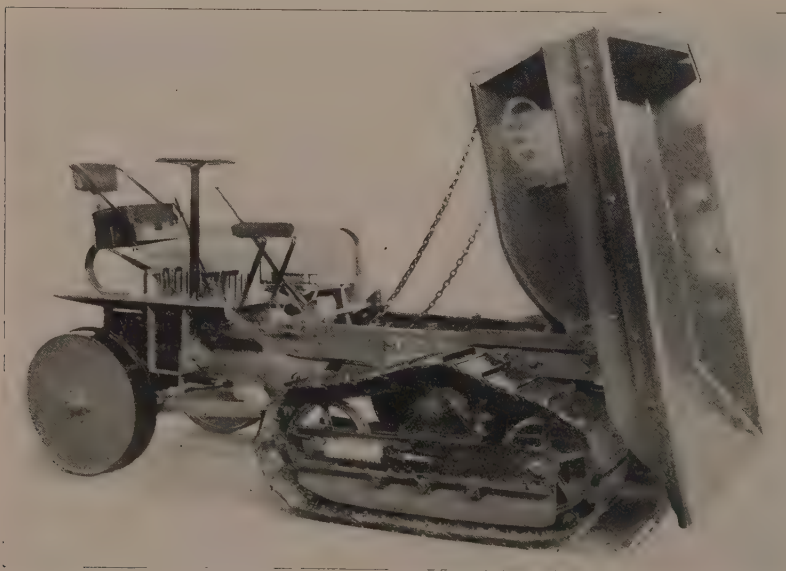
Hydraulic pressure is supplied by the Euclid simplified hydraulic pump attached to the rear of the tractor. This compact pump with few working parts, including the Euclid improved valve, assures proper pressures and eliminates excessive leakage so often found in this type of equipment.

The door-lifting jack is located inside the tubular section of the wagon drawbar. This design affords complete protection for the jack and keeps out the dirt and dust. The end of this tubular section carries a removable cover plate. When this plate is off, the jack can be easily pulled out from the end of the drawbar for inspection or repair.

Full 7-Cu. Yd. Capacity.

Having previously produced crawler wheels which proved successful for dirt-hauling operations, the Trackson Co., Milwaukee, Wis., introduced a complete 7-cu. yd. crawler wagon during the year.

This Trackson product, which is illustrated here, is a bottom-dump cart-type wagon designed to meet the



The Ohio tractor dump wagon in "bull-dozing" position.



The Trackson crawler-mounted wagon.

requirements of heavy dirt-moving work. It has the features that practical operators demand—extra-strong front and rear ends, improved tongue and drawbar connections, a sturdy body that sheds the dirt, a simple, easily-operated door-winding device, greater clearance on the dump, light weight and extraordinary strength, improved design, renewable parts, and, most important of all, crawler wheels which pull easier and which will stand up for a long life of hard service.

The Trackson crawler wagon is strong and light, weighing only 8,800 lb. complete. It is built entirely of steel, with special re-inforcements at the points which are subject to greatest wear and strain. At the front and rear ends, for instance, are box-shaped, cast-steel headers which are much stronger than the channel-steel headers usually found in dirt wagons. Extra-heavy 8-inch pipe provides a straight, tubular tongue of the strongest possible construction, which is clamped between the two front header castings and thus practically becomes an integral part of the frame structure. The tongue leads at an angle direct from the front header of the wagon to the tractor drawbar, which is much stronger than the goose neck type and permits the wagon to make right angle turns just as easily.

An All-Steel Wagon.

The LaPlant-Choate wagon was developed to meet the requirements of speedy and efficient operation combined with strength and long life.

Designed to carry between 7 and 8 cu.yd. of material, the "Roadlayer" wagon is built entirely of steel, hot riveting and electric welding being used throughout. The frame is constructed of heavy-section channels riveted and electric welded.

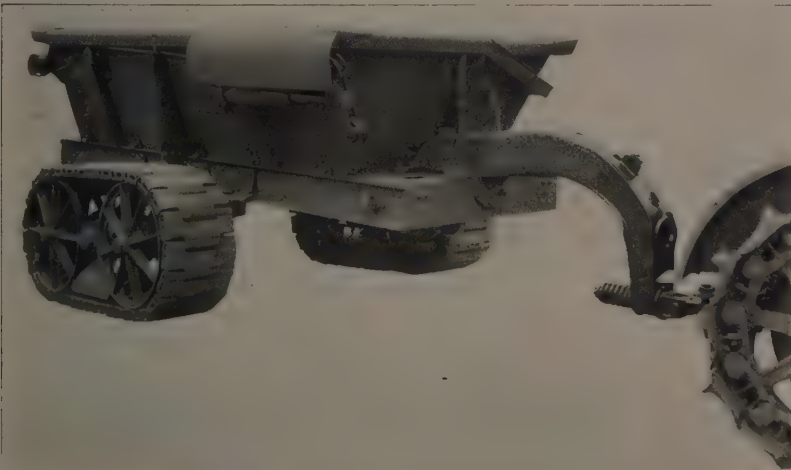
There are many features which are distinct advantages. The absence of wheels in front prevents miring, reduces the drawbar pull required, and eliminates "jack-knifing." The tracks on the wagon follow directly in the path of the tractor tracks.

The wagons may be obtained with or without flareboards for use with shovel-loading outfits. This flareboard gives extra carrying capacity, and is quickly attached or removed as needed.

A cast-steel box is provided at the rear of the wagon through which the rear drawbar is fastened.

A simple swivel-type step is provided on the left side, so attached that it will fold up under the wagon body when obstructions are hit. The step is made like an open grate so that it will clean itself of mud.

The dump wagon is one of the products introduced in 1931 by the LaPlant-Choate Manufacturing Co. of Cedar Rapids, Ia.

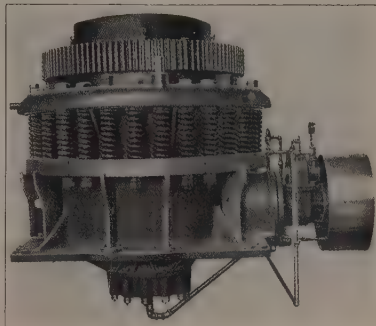


All-steel La Plant-Choate dump wagon on crawlers.

Crushing and Grinding

New Cone-Type.

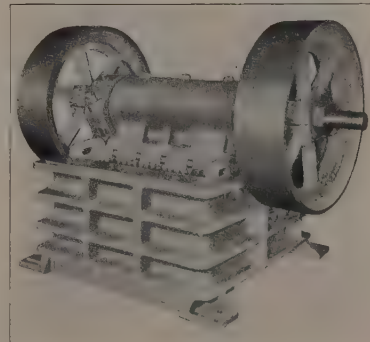
In the new TelSmith cone crusher, introduced in 1931 by the Smith Engineering Works, Milwaukee, Wis., the conical head gyrates so rapidly that every piece of rock is pinched several times during the progress through the crusher. Very little over-size material reaches the discharge opening. The spring release of the upper frame effectively checks packing and eliminates danger of breakage by tramp iron. The enormous bottom diameter of the head and the long head movement likewise operate to prevent any



The new TelSmith cone crusher.

choking action, even under a heavy accumulation of hard rock.

The TelSmith cone crusher discharges by gravity, through the three-arm bottom spider. The countershaft box and spider arms are protected by steel shields. The discharge chute is independent of the crusher structure,



The Badger roller-bearing jaw crusher.

and may be attached at any desired position. There is no built-in discharge chute to hinder discharge, and there is no centrifugal action to wear out the discharge chute.

All bearings in the crusher are lubricated by force-feed, with oil pressure gauge and automatic relief valve to regulate the oil pressure. The oil pump is of the self-priming internal-gear type, driven by cut spur gears.

Roller-Bearing Jaw Type.

The newly-announced Badger roller-bearing crusher manufactured by the Wisconsin Foundry & Machine Co., Madison, Wis., is a jaw-type stone crusher capable of increased output

through easy, vibrationless operation.

The Badger crusher is especially built for use with portable plants where very hard stone is to be crushed. To meet the requirements of portability and large capacity production with hard stone, the crusher is built with the following features:

The frame is low, deeply ribbed, and thoroughly reinforced, and is capable of withstanding the most severe shocks. The machined frame assures alignment of parts and the uniform distribution of strains to all parts of the frame.

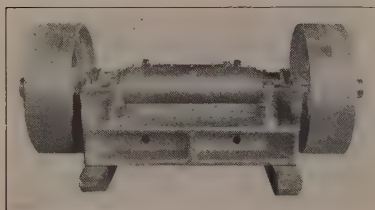
The shaft is extra large in diameter and made of high-grade heat-treated alloy steel. It revolves on proportionately large Timken roller bearings and carries the pitman. The movable jaw is locked by a steel wedge which is bolted to the pitman.

The outer roller bearings on the shaft are set in machined boxes which are split and bolted to frame. This makes the bearings accessible for inspection and facilitates field repairs.

Piston-ring seals enclose the bearings and entirely prevent dust from entering.

New Reduction Crusher.

The new Cedar Rapids 3-in. by 36-in. heavy-duty reduction crusher is one of the new units comprising the Cedar Rapids line which was an-



Cedar Rapids heavy-duty reduction crusher.

nounced by the Iowa Manufacturing Co., Cedar Rapids, Ia.

This crusher is particularly characterized by its rugged construction and heavy-duty features, which includes extra large phosphor-bronze bearings, centrifugally cast, insuring against porosity and nonuniform metal density; heavy-duty, special heat-treated chrome-nickel eccentric shaft; large counter-balanced flywheels; all steel base frame and pitman made from electric cast steel; special force-feed lubrication in the pitman bearings and ring-oiled-type lubrication for the side bearings. All wearing parts are made from either special alloy-cast steel or high-carbon cast steel. Every necessary precaution has been taken to develop a high speed reduction crusher of especially long durability and high capacity.

This unit can be furnished as a separate crusher on skids for installation in stationary plants along with primary breakers or can be built into combined portable units such as the Cedar Rapids 936-336 one-piece outfit which is designed to screen, crush and load all in one operation.

Pulverizer Is Redesign.

The Grindle Fuel Equipment Co., a subsidiary of the Whiting Corp., Harvey, Ill., announced during the year that it had taken over the manufacture and the sale of the table-roller pulverizer previously handled by the Bethlehem Steel Corp.

Important changes were made in the design of the bearings, the rollers, the lubrication (which is now entirely forced oil) the setting of the table on the main shaft, the seal protecting the driving gear against dust, the air classifier, etc. One-piece tracks are replacing the segmental tracks used previously. Furthermore, it is possible now to run the pulverizer at very low capacity, or at maximum capacity with equally good results, an important feature for industrial plants with variable loads.

The most outstanding advantage is claimed to be the extremely low power consumption.

Heavy-Duty Gyratory.

A new reduction crusher of great promise is being offered to the trade by the Traylor Engineering & Mfg. Co., of Allentown, Pa. The machine, which is styled the Type TZ, is designed with extra heavy proportions and built in six sizes capable of hourly production ranging from about fifteen tons, ½-in.-ring size, in the smallest machine, to nearly one thousand tons 2½-in.-ring in the largest size. This unusually wide range, the manufacturers feel, will meet any need.

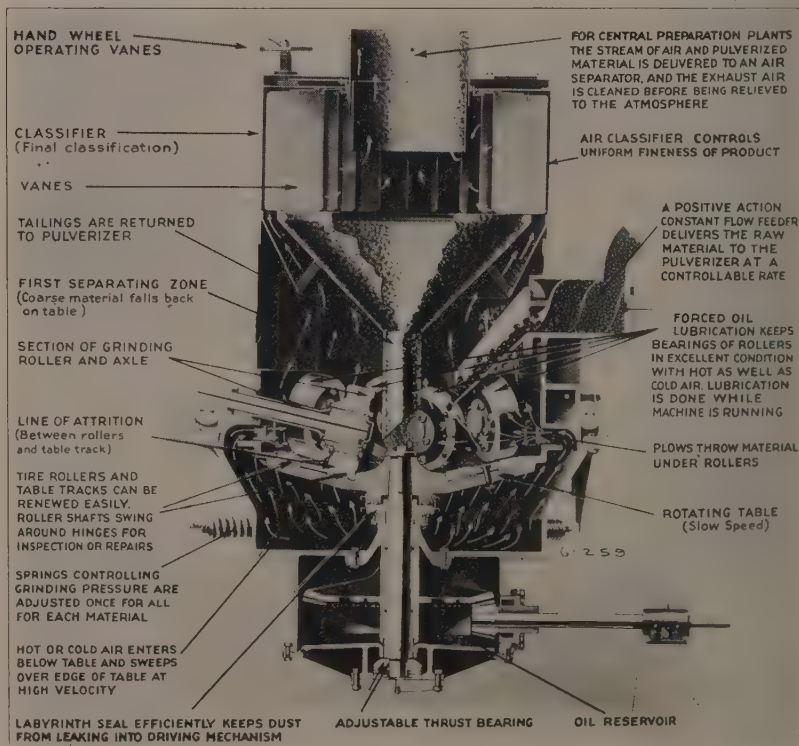
The crusher is of the gyratory type with a bell-shaped crushed head, and



Traylor Type TZ 15-in. gyratory crusher.

the concaves are sharply convexed from top to bottom of the bowl. This design eliminates choking because the normal choking point of a standard type gyratory crusher (at the bottom of the head) has been moved upward to a point where the tendency to choke disappears. This elimination of choking results in a higher rate of output and finer and much more uniform product with a reduced percentage of undersize.

The Traylor Type TZ reduction crusher is designed with a balance lever and tension springs to support the head and shaft, the springs being adjusted to a tension sufficient to with-



Explanatory view of the Bethlehem table-roller pulverizer.

stand the downward thrust of the head due to crushing, and yet to allow the head to be depressed to a liberal degree.

The TZ crusher will receive and crush larger rock than any other cone-type secondary-reduction machine, and the head may be accurately adjusted, during operation, for varying the size of product. The adjustment range, in any one machine, is fifty per cent—that is, if the original coarsest setting is 1½-in., the machine may be adjusted to break to ¾-in. or anything between these limits.

Screening

Counter-Balance Assures Smoothness.

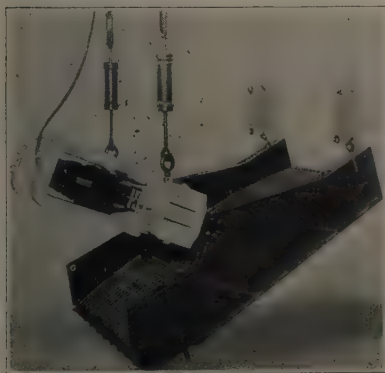
The new Simplicity utility gyrating screen announced by the Simplicity Engineering Co. of Durand, Mich., is said to be the original type of mechanically-vibrated screen using a counter-balanced eccentric shaft. This counter balance is machined directly on the shaft, thus giving positive action with perfect smoothness. A simple balance compensator mounted on the end of the shaft allows the field operator easily to adjust for any changes in screen-cloth weight so as to maintain perfect balance and smoothness.

Resilient rubber mountings support the screen corners so that all the positive gyrating action is imparted to the screen decks and not lost by being dissipated throughout the supporting framework. This eliminates excessive structural wear and increases the screening efficiency.

The screen cloth is stretched taut all four ways over bars which are crowned both sideways and endways. This does away with cloth sag. The screen can be furnished in various sizes and in single, double- and triple-deck types; flat pulley, V-belt drive and direct-motor drives, too, can be supplied. The motor-driven unit has the motor mounted directly on the end of the shaft, an exclusive feature. This does away with belts, gears, pulleys and couplings, providing a very safe and quiet running unit.

Alternating-Current Screen.

The Traylor Vibrator Co., of Denver, Colo., early in the year announced



New type Traylor vibrating screen.



The Barber-Greene loader with vibrating screen in operation.

the development of the Trayco Conveyanscreen. The screen brings a number of new and interesting practices to the art of screening. The power unit, designated as the vibrator unit, is mounted above the screen sash and imparts its vibration at an angle to the screening plane. This rapid oscillation produces a sharp screening action as well as a conveying motion. Thus, the screen can be operated practically flat and, therefore, does away with the necessity of setting the screen at an angle where gravity will cause the flow of the material across its surface.

The manufacturer states the Conveyanscreen produces more accurate sizing because the angle of vibration causes the material to keep in closer contact with the screen cloth. The power units which vibrate the sash are the same type and design as those used on Traylor vibrating conveyors which have been in use in conveying practice a number of years. The vibrator is suspended so that all the vibration is absorbed within the unit and none is transmitted to building supports.

The power unit takes its energy from any standard alternating current and through the use of a small motor-generator set, furnished with the screen, the intensity of the vibration is under rheostat control and can be varied to meet individual requirements.

The screen is furnished in four standard widths and in any length necessary to accomplish the duty.

Screen for Portable Loaders.

A new three-product vibrating screen for use with its Model 62 heavy-duty self-feeding bucket loader was introduced by the Barber-Greene Co. of Aurora, Ill. The screen is designed for operation in gravel pits, on road jobs, or in any place where bulk material must be classified by size. It will take gravel direct from the bank in a pit and load it out as over-

size, gravel, and plaster sand. When such a fine classification is not desired the screen may be made into a two-product unit by removing one screen cloth.

The new screen is made up of two screen cloths vibrated at 1,200 r.p.m. by an alloy-steel eccentric shaft driven by a power take-off direct from the main transmission of the loader. A belt that can easily be removed and rethreaded transmits the power to the screen.

Material discharged from the buckets of the loader falls first on a large-mesh screen cloth which removes oversize, carrying it off over a steel chute. Shaken through the first screen, the material drops on a finer mesh below. The finest size falls through this cloth onto a rubber belt conveyor which carries it out and discharges it at a point 9 ft. from the center of the machine, while that which remains on the second screen passes off over a chute.

Allis-Chalmers Screens

During the year the Allis-Chalmers Mfg. Co. made a number of improvements to its centrifugal vibrating screen. An improved type of screen suspension has found considerable favor with operators. Also, during 1931, screens having one, two, or three decks were developed in the 4 ft. by 10 ft., 5 ft. by 10 ft., and 5 ft. by 12 ft. sizes. The 5 ft. by 12 ft. double-deck screen is of the general type shown in the photograph at the top of the next page. During 1931 there was considerable demand for stone-and-gravel washing equipment, and in order to meet this demand the company redesigned and improved its screw and log washers. A steel-plate casing of welded construction throughout is being used on the sand screw washer. On the log washer it likewise standardized on steel-plate construction with the log made up of standard sections and provided with renewable plates.

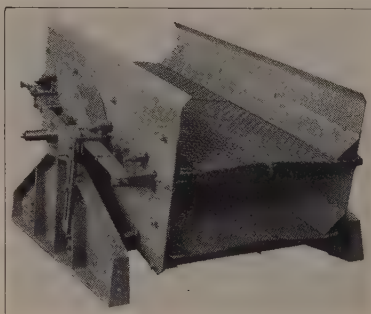


Allis-Chalmers vibrating screen.

Roller-Bearing Vibrating Screen.

One of Kennedy-Van Saun's developments in 1931 was the roller-bearing vibrating screen, shown in the accompanying illustration. There is a gyroscopic eccentric flywheel attached to the shaft and the spreader sleeve which forms a housing for the Timken roller bearings between the housing and the gyroscopic eccentric flywheel and places the load directly under the side frames which eliminates all overturning, or bending, moment in the drive shaft. The spreader sleeve surrounding the shaft forms the housing heretofore referred to but has flanges cast integral to which is riveted the side frames. Users of screens all know the difficulty they have had in keeping the bolts or rivets in the screen side frames from tearing through. This side frame is reinforced with extra heavy plate at the point where reinforcements are needed but leaving the rest of the screen frame made up of standard thickness plate, and none of these side frames have ever failed. The face of the spacing sleeve is machined off and to it is attached the machine closure plate for sealing the grease in the bearing as the centrifugal force on these bearings throws the grease outwardly and there is no possibility of

grease bespattering the screen or the operator. This screen is unique in that the bearings are held in juxtaposition by nuts on the shaft pressing the bearings against shoulders on the shaft thus positioning the parts against parts that move at the same time, thus eliminating wear from grit or dirt. The drive shaft is mounted in ball and socket bearings and the roller bearings are mounted in the ball so that the machine is self-aligning in every direction. To prevent the KV drive from excessive wear a housing is placed over the drive so that the



View of the Gyrex screen.

dust and dirt which has a tendency to cut and destroy the belting is effectively excluded. This screen may be set on the screen floor proper or it may be suspended on cables or bars with turn-buckles, making it easily adjustable if adjustment is found necessary.

An All-Purpose Screen.

The Style C Gyrex was introduced in 1931 by the Robins Conveying Belt Co. In its various models and strokes it provides an all-purpose screen. It will efficiently and continuously handle large or small tonnages, for coarse or fine sizing, of heavy, light, wet or dry material.

By virtue of its unique spring arrangement and simple rugged actuating unit, it is a perfectly smooth- and quiet-running screen. Whether it is separating coke breeze through a $\frac{3}{4}$ -in. mesh, or trap rock through a 4-in. mesh, its action is just as smooth and quiet. It can separate sand and gravel to meet the most rigid road construction specifications or make coal into its accepted domestic sizes.

The Style C Gyrex consists of four elements—the live frame, the vibrator, the springs and the base. The proper relation of these four elements is essential to a smooth-running and long-lived screen.

The live frame is actuated by the vibrator and supported by the springs. Both the springs and the

vibrator are supported by the base.

To secure smooth action, the vibrator must be located at or near the center of gravity of the live frame. To obtain long life of eccentric bearings in the vibrator, these bearings must be relieved of all duties except the job of imparting the circular gyration to the live frame. To insure long life of the screen as a whole, the base must be solid and rigid and not subjected to great vibrations from unbalanced loads.

This essentially correct relation between the four elements is produced in the Style C Gyrex with the greatest degree of simplicity and the smallest number of parts, making it the most easily assembled, or dis-assembled and the most readily installed screen on the market.

Gasoline Engines

New Continental Sixes.

Deliveries were made during the year on another new series, in four sizes, of Continental 6-cylinder, L-head engines to be known as the E-600, according to L. J. Kanitz, general sales manager of Continental Motors Corp. This group, designed for high speed and performance, yet of comparatively low weight, in no wise supplants any of the former Continental models but, provides an even more closely graduated series between the well known Model 16-C and the heavier R-series of overhead valve type.

All of the new engines are of $4\frac{1}{2}$ -in. stroke, but the bores are $3\frac{1}{16}$, $3\frac{3}{8}$, $4\frac{1}{8}$ and $4\frac{1}{4}$ -in., with displacements of 288.3, 318.0, 360.7, and 382.9 cu. in., respectively. Several striking features of design in manifold, camshaft, and combustion chamber have resulted in a happy combination of unusually high torque characteristics over a wide speed range. At the same time strength and sturdiness have been coupled with low weight. Full provision has been made in the basic design for all the current accessories, such as oil filter, air cleaner, air compressor, etc., and for dual ignition.

Adds L-Head Series.

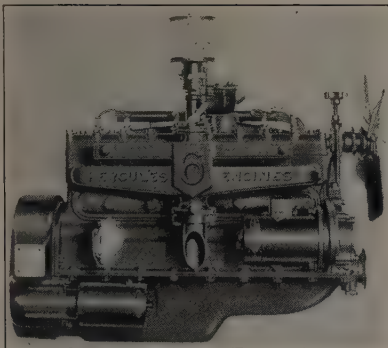
The Hercules Motors Corp. of Canton, O., is offering an additional line of heavy-duty, six-cylinder L-head engines designated as the JX series. This series is available in three different sizes, as follows:

Model	Bore	Stroke	Displacement
JXA	$3\frac{3}{8}$ in.	$4\frac{1}{4}$ in.	228 cu. in.
JXB	$3\frac{5}{8}$ in.	$4\frac{1}{4}$ in.	263 cu. in.
JXC	$3\frac{7}{8}$ in.	$4\frac{1}{4}$ in.	282 cu. in.

All three engines are identical in design and in installation dimensions. They differ only with respect to the bore and such parts and performance ability as are thus affected.



Kennedy-Van Saun vibrating screen.



Hercules 6-cylinder engine as seen from the manifold side.

The crankcase is cast integral with the cylinder block, assuring extreme rigidity and permanent alignment of bearings.

The crankshaft is supported by seven main bearings, all $2\frac{1}{2}$ in. in diameter. The total projected area of these bearings is 27 sq. in.—a high ratio of displacement to bearing area which reduces pressure per square inch of bearing, and combined with efficient lubrication, assures long bearing life. Cylinders are cast en bloc with detachable head. Connecting rods are drop forged. The bearing material is cast into the rod, as well as in the drop-forged caps—and the caps are held by special heat-treated bolts.

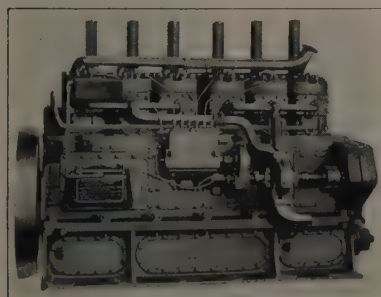
Lubrication is by gear pump of large capacity providing full pressure to all main and connecting rod bearings.

Hercules also presented a line of small, modern four-cylinder engines and power units designated as the Hercules IX Series. Models are available in the following bore, stroke and displacement.

Model	Bore	Stroke	Displacement
IXA	3 in.	4 in.	113.1 cu. in.
IXB	$3\frac{3}{4}$ in.	4 in.	132.7 cu. in.

Introduces Two Small Fours.

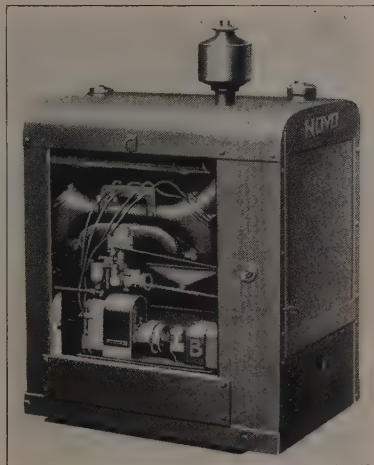
The Waukesha Motor Co. entered a new field in the industrial engine market by the manufacture of a series of two small four-cylinder engines of 10-hp. to 20-hp. size. Formerly, engines under 20-25-hp. were not available but with the addition of the FLJ and FKJ, known as the "agile fours," this company stepped squarely into the center of a new market.



New Waukesha 200-hp. Diesel.

These smallest Waukesha engines have all the ear-marks of their bigger brothers. They have the standard Ricardo combustion chamber, short, stiff crankshaft supported by three unusually large, bronze backed replaceable bearings, full pressure oiling, built in governor and detachable fly-wheel housing. In addition to these standard and typical Waukesha features, there is an unusual degree of flexibility in the facility for mounting accessories. It is possible to install a full series-type oil filter, complete electric-starting and lighting system, three-point suspension, either battery or magneto ignition, all of which are available and add greatly to the popular appeal of this engine.

The full-pressure oiling system with drilled crankshaft and outside pressure adjustment is not commonly found in engines as small as these. The oil is distributed by a positively driven gear pump submerged in the



Novo 4-cylinder engine.

oil reservoir and surrounded by the Waukesha oil-level equalizer. This feature insures a positive supply of oil under full pressure at all levels and temperatures.

New Four-Cylinder Unit.

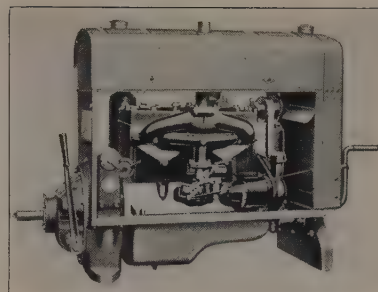
The new four-cylinder 10-14 hp. Model NNU engine announced by the Novo Engine Co. fits into a great many power requirements in sand-and-gravel and quarry fields where a lightweight, four-cylinder engine is needed.

The Model NNU has a high-compression head, three-bearing crankshaft, is equipped with Timken and New Departure ball bearings. The cylinder block is cast of a chrome nickel-alloy which gives a great transverse strength and insures long life.

The engine is equipped with a simple gear oiling system, which is efficient regardless of temperature or condition of oil.

A Brand New Diesel.

The Waukesha six-cylinder Diesel of 180-200 hp. was shown to the public for the first time at the 1932 Road Show. It is a $7\frac{1}{2}$ -in. by $8\frac{1}{2}$ -in. engine



Small Waukesha industrial power unit.

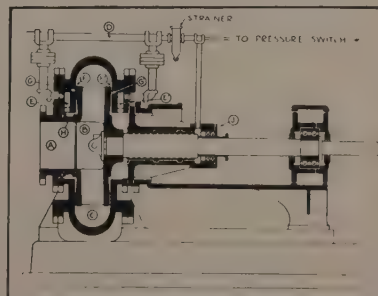
and follows the essential features of the four-cylinder Diesel that was introduced a year ago. It is a four-cycle, solid injection unit with Bosch injection pump and fuel system, a special compressed air starting system, and the Waukesha ell head, high turbulence combustion chamber. Since engines of this type must be started by mechanical means, the gasoline auxiliary starting system that was shown on the four cylinder engine last year is of no practical advantage, and is omitted. This engine is complete with fuel, air and lubrication filters, and all necessary attachments for placing it in immediate operation.

Pumping Equipment

An Unconventional Pump.

The Hydroseal pump, built by the Allen-Sherman-Hoff Co., Philadelphia, Pa., is said to overcome high maintenance, low average efficiency, and discharge-pressure limitations that are inherent in ordinary dredge pumps. It is not built along conventional lines. The operation of the Hydroseal unit is identical with that of a standard centrifugal pump. Attention, however, is called to the following unique features which are shown in the accompanying diagram-section.

Clear water at a pressure that is low relative to the pump-discharge pressure is connected through pipes to the header *D*, this water passing into chambers *E* and *E'* on both sides of the impeller. Due to the adhesion of this water to the side surfaces of the impeller and because of the close clearance at points *F* and *F'*, the initial pressure of the clear water is boosted above the pressure in the main volute *C*. The annular clearances *F* and *F'*

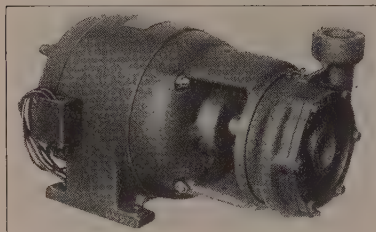


Section of Hydroseal showing method of sealing with fresh water.

are thus continuously filled with clear water flowing into the volute *C*, not with abrasive-material-laden water flowing in the opposite direction. It is evident that the abrasives in the water can not wear the outside of the impeller shrouds or the side plates *G* and *G'*.

Leakage through the sealing ring *H* is low-pressure clear water only, not high-pressure abrasive-laden water. The efficiency of the sealing ring is thus maintained and the pump can retain its initial efficiency and discharge head indefinitely.

The clear water introduced at *E* and *E'* need not be at a pressure higher

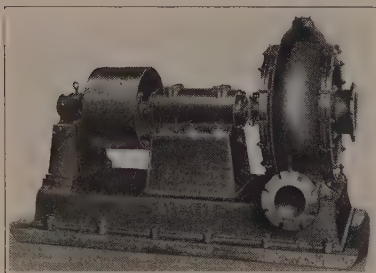


Monobloc centrifugal pumping unit.

than the pump-discharge pressure. The gland *J* merely holds the low-pressure clear water in the annular bearing and therefore requires little attention. Abrasive water can not leak along the shaft.

A General Service Unit.

There long has been a need in the industry for a centrifugal pump of good efficiency, low initial cost and low maintenance expense—the design and construction of which is such to insure



Amsco pump for handling abrasive materials.

good service with but little care and attention. This need was met by the Monobloc Type D centrifugal unit, according to the Worthington Pump & Machinery Corp., Harrison, N. J., which placed the new unit on the market in 1931.

The pump, simple and rugged, is bolted to the extended motor frame and the impeller is mounted on the end of the continuous motor shaft. The bronze impeller incorporates the shaft sleeve as an integral part, this construction being one of Worthington's latest shaft-protection developments. The cadmium-plated steel locking device for the impeller, the forged bronze packing gland, and the arrangement of shaft water-thrusters, are other important features of this pump.

The ball-bearing Masterbilt motor, designed especially for Worthington, incorporates standard electrical construction. Combined with the pump, it affords a high-class, moderate-priced pumping unit for the services for which it is intended.

Bearing Arrangement Absorbs Shocks.

The American Manganese Steel Co., Chicago Heights, Ill., added the new Type C model to its line of abrasive-materials-handling pumps. This new pump is strictly of Amsco design, and is made of manganese steel.

Many new features have been included in these pumping units. Bearings are interchangeable in the field, either sleeve or anti-friction types being available. Lubrication is required on main bearings only (except where outboard bearings are used). Impeller clearance and main bearings can be adjusted easily without dismantling and thrust and radial shocks are completely absorbed by new bearing arrangement.

The new Amsco Type C pump will meet the strictest present-day demands for long life, high capacity and low first cost as well as low-operating cost, according to the manufacturer.

Feeders

Manganese-Steel Apron Feeder.

A new, distinctive design of heavy-duty manganese steel apron feeder was the Link-Belt Company's answer to the growing demand for a sturdier, more dependable, more durable type of apron feeder for heavy-duty service.

The new feeder is suitable for handling either abrasive or non-abrasive material containing lumps of ¼-in. size, and smaller, up to 6-ft. dimensions, being especially well adapted to the handling of extremely heavy, large, lumpy and abrasive materials.

The sprockets, chains, rollers and over-lapping "non-sagging" apron pans are made of cast manganese steel, and the pans, which are ribbed, are ¾-in. to 1½-in. thick, depending upon the service.

The chains have no small rollers (therefore there are none to lubricate), and they are placed underneath the pans at locations which break up the span of the pans. They are protected from dirt, and the stiff-back arrangement requires only a minimum of space and width for the feeder.

The broad wearing surfaces of the links of the rivetless manganese-steel chains form substantial tracks for the large manganese-steel rollers, supporting the material-carrying run.

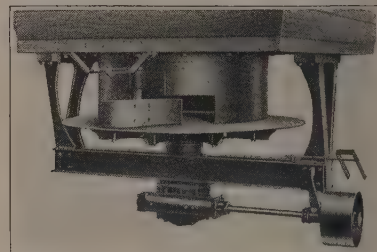
Disk Feeder for Fine Materials.

The Concenco disk feeder, recently developed by the Deister Concentrator Co. of Fort Wayne, Ind., is a simplified machine for metering crushed and ground materials. It is sturdily built and designed to give continuous operation at the lowest cost possible.

The feeder, according to the manufacturer, will accurately feed at any wanted capacity and is very efficient in handling all fine materials, such as sand, ground clay and shale, as well as gravel and crushed rock, coal, etc., up to 3 in. cubes.

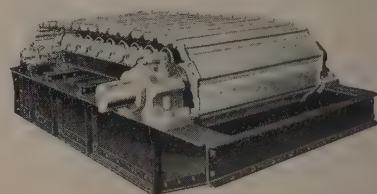
The renewable disk is a 60-in. steel circle made of heavy steel plate bolted to a cast iron spider. The spider is bored and keyed to the heavy vertical shaft.

The drive is by means of worm gearing which is accurately machined, ball-thrust-bearing and roller-bearing equipped, running in oil and incased with dustproof housing. (The drive



Concenco disk feeder suspended from leg brackets beneath bin.

can also be furnished by means of bevel gears.) The worm-gear shaft is driven by tight and loose pulleys and is also furnished with clutch pulley as an extra or sprocket for chain drive. The stopping and starting of the feeder can be so arranged to work automatically with any other unit. angle of plow which can be set for any capacity. It can be adjusted to suit any condition while operating without the necessity of a shut-down.



The Link Belt apron feeder.

Assures Uniform Speed.

The construction and operation of the new Huron feeders, manufactured by Huron Industries Inc., Alpena, Mich., is extremely simple, a feature which reduces to a minimum the amount of investment and maintenance required.

Each feeder consists essentially of a receiving box, a feeding box, three gear-driven conveyor screws, and a discharge box. There are no fine adjustments, no parts that are subjected to excessive wear, and no complicated parts that might get out of order and be difficult to replace. In fact, all the parts are of the kind with which operators of this class of equipment are entirely familiar.

The bin is bolted to and supported by a receiving box with a rectangular opening of sufficient size to permit an ample flow of material, taking into ac-



Huron feeder handling dry raw mix to cement kilns.

count the angle of the side walls of the bin. The receiving box is divided into two sections, and below the sections are two screw conveyors which work against one another. This arrangement causes the material conveyed by each screw to meet just above the feeding box. The latter is equipped with an overflow compartment, at the bottom of which the material is continually agitated by the incoming material, thus bringing the pulverized coal or raw mix to a uniform density and aerating it, the air being released and escaping through vent pipes up the sides of the bin. The conveyors are designed so there is sufficient material conveyed to the feeding box to keep a continual supply in the bottom of the box, from which it is conveyed to the discharge box by means of a screw. The latter is keyed to the drive shaft, which is connected to the upper conveyor shaft by a spur gear and pinion.

Constant-Weight Feeder.

This year, through the large demand for the Hardinge constant weight feeder in fields where a very sturdy and heavy-duty device is required, the Hardinge Co. have developed a heavy duty feeder which is capable of withstanding unusual service and rough treatment. One of the important features of this feeder is the large hopper opening which was also developed to handle wet and sticky materials. The hopper opening is sufficiently large to



Hardinge constant-weight feeder.

prevent bridging in the bin. This feeder is also capable of feeding coarse pieces up to 6 in. in diameter. The belt speed can be varied so that a wide range in capacity is possible; viz., where a very slow belt speed is used, the capacity can be as low as 20 lb. per hour, but where a higher belt speed and larger gate opening is maintained, the capacity can be as high as 650 tons per hour, feeding either coarse or fine material.

Loading

Grizzly Crawler Loader.

Continuing a policy of constant study and improvement of its complete line of portable-loading equipment, Link-Belt Co., Philadelphia, Pa., announced the 1931 model Link-Belt grizzly-crawler loader.



Link Belt grizzly crawler loader.

The 1931 grizzly has the improved helical-ribbon-type feeder, announced in 1930, with its cast-steel spiral which digs, lifts and conveys the material to the buckets, cutting a 7-ft., 7-in. swath in the material handled.

The power plant consists of a 30-hp. Buda gasoline engine, equipped with a governor to regulate the speed auto-

matically; or a 20-hp. electric motor of standard specifications.

The elevator has a rated capacity of 1 $\frac{3}{4}$ cu. yd. per minute, with uniform feed, based on sand, stone and gravel, 1 $\frac{1}{2}$ in. and smaller and similar materials.

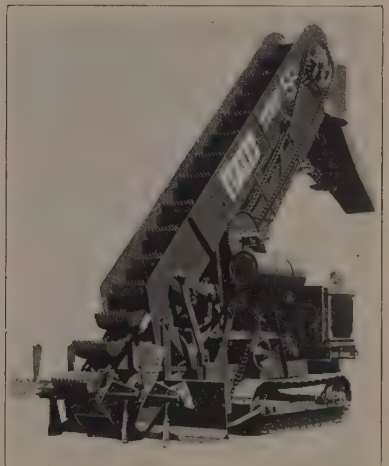
A three-speed transmission gives the crawlers a speed of 30 ft. per min., or 66 ft. per min. in the digging direction, and 27 ft. per min. in reverse.

Driving machinery is housed in a dust-tight casing, partly filled with oil, which assures perfect lubrication of all parts.

Moderate-Sized Machine.

In the belief that there are in existence many stock-pile loading jobs which do not require the full power and capacity of regular Haiss models, the George Haiss Manufacturing Co. designed a loader especially for average stock-pile loading requirements—a powerful, high-speed machine at a moderate cost.

Despite its popular price, the Haiss 50 is built with the same strength, pre-



Haiss high-speed stock-pile loader.

cision and quality throughout, as are the large Haiss machines now in use. It has a capacity of from 1 $\frac{1}{2}$ to 1 $\frac{3}{4}$ cu.yd. per min. handling materials in lumps not larger than 6 in. and weighing no more than 125 lb. per cu.ft.

Driven by a 37 hp. 4-cylinder engine equipped with intake air cleaner, oil filter, gasoline strainer and inbuilt governor, the Haiss Model 50 has the extra power which assures continued adherence to its rated capacity schedule.

It has an enclosed roller-and-ball-bearing transmission, with all gears and clutches running in oil. Another important feature is the feeding device, which consists of the patented manganese-steel feeding propellers for which the larger Haiss machines are well-known. Manganese steel has been incorporated at many other points of wear so that the life of the machine is considerably lengthened.

Box-Car-Type Machine.

A new small bucket loader that will operate inside a box car and will han-



Small Barber-Greene bucket loader inside car.

die any bulk material with lumps not exceeding 4 in. at the rate of $\frac{1}{2}$ cu yd. per minute was one of the new items presented by the Barber-Greene Co. of Aurora, Ill.

It is wheel-mounted and self-feeding and is powered by a 5-hp. 1,800-r.p.m. ball-bearing electric motor. The motor is totally enclosed in the machine, and fan-cooled.

The loader was originally designed for unloading bulk cement from box cars, but its use extends to handling grain, fertilizer, fullers' earth, nut and slack coal, silica, and other bulk materials, and loading wheelbarrows, buggies or conveyor hoppers.

A pawl-and-ratchet feeding mechanism is used for crowding the machine into the material. By simply reversing the pawl, the feeding drive is reversed for backing out. A simple arrangement on the pawl and ratchet makes five feeding speeds available in both directions. When the machine is not feeding and is to be moved about, the drive is disengaged and one man tilts the boom back on the chassis, raising the feeding end off the ground. This is easily done since the boom is supported on the chassis almost at the center of gravity. The machine is mounted on two 30-in. roller-bearing wheels with a 10-in. roller-bearing caster for steering, making the machine easily and quickly movable by one man.

Dust Collecting

New Cloth-Envelope Filter.

In May of 1931 the Sly dust filter was put on the market by the W. W. Sly Manufacturing Co. This filter is a new development insofar as it represents radical changes and very decided improvements in the design and construction of the cloth type dust collector.

The Sly filter is neither a screen-type nor a bag-type collector. The filter cloth is made up into individual

envelopes which are fastened in a new, simple and ingenious way, permitting of easy insertion and quick and easy replacement without plant shutdown.

Another feature of utmost importance is the fact that the cloth envelopes are held constantly under tension regardless of moisture or temperature conditions and regardless of stretch in the cloth.

The tension on the envelopes has a number of advantages. It makes up any stretch in the cloth which otherwise would tend to have the cloth surfaces touch which in turn would reduce the effective filter area and increase the strain and wear on the cloth and fan power requirements.

The cloth under tension permits more rapid and effective dust removal. This dust removal or cleaning of the envelopes is accomplished in an entirely new manner. Steel tape, under tension, extends from the front to the rear of the filter in every interstice between the envelopes. Attached to this tape there are three spring steel vibrator rods which, as the steel tape is vibrated, lightly tap the taut cloth surfaces and almost instantaneously remove the adhering dust.

Another advantage of this new filter design is that for a given filter cloth area it occupies only one-half of the space required for the old design. This means a reduction in first cost, an economy in space where space is at a premium, and a lower cost of supporting structures.

These advantages have facilitated the use of a continuously operated dust filter. A 1931 development of this continuous type of filter is the use of electrical control appliances for automatic operation.

Installations of this new Sly dust filter were made at a cement plant near Birmingham, at the South Dakota cement plant, and a large double continuous unit is now being installed in Texas.

An Improved Cyclone.

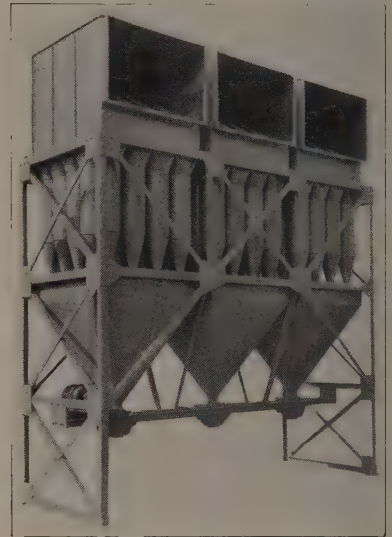
Sound engineering combined with good scientific thought has attacked the dust-collecting problem in several first-class research establishments and one of the most successful collectors placed on the market this year is known to the trade as the Multiclone, and is manufactured by the Western Precipitation Co. of Los Angeles.

Unquestionably the first type of "dust catcher" devised by mankind was a settling chamber, and these are still in very common use. Next an effort was made to improve the settling effect by baffles, plates and other obstructions in the settling chamber. This quite as often resulted in decreased efficiency as in increased dust collection. Then followed an effort to increase the gravity effect by centrifugal action and the cyclone came into service. Cyclones still serve the industry well and where dust particles are relatively coarse and a high efficiency is not essential, they find a field of real usefulness.

In a thorough-going investigation of

a number of methods of dust collection, study was directed to the fundamental requirements for high efficiency of centrifugal equipment. These may be simply stated as follows:

1. The diameter must be small; 2. the angular rotation must be high; 3. a sufficient interval of time must be provided for separation of dust and gas to take place; and, 4. properly proportioned and located discharges must be provided for the separated products—cleaned gas and dust stream. These requirements were satisfactorily



Multiclone dust collector.

met by a tube-type of cyclone with an involute or vane type inlet, a truncated-cone dust discharge to a dust hopper and a cleaned-gas outlet central to the gas vortex.

Such a single tube for high efficiency and of a diameter of, say six to ten inches, gave only a very limited gas volume capacity, scarcely sufficient to consider it as of commercial interest. The assembly of a number of such tubes into a single unit with common inlet, outlet and dust hopper made a highly satisfactory industrial unit. Two models are being manufactured, employing 6-in. and 9-in. tubes, respectively.

Speed Reducers

Combination Multi-Speed Drive.

A multi-speed reduction-gear unit, built in combination with a standard a.-c. motor, was developed by Roy T. Wise, consulting engineer, Westinghouse Electric & Manufacturing Co. Constructed to give four different speeds to the output shaft at constant horsepower, this unit, known as the Westinghouse-Wise multi-speed drive, is applicable to those many industrial operations which, for highly-efficient performance, require drives providing more than one speed. With this drive the speed of the driven apparatus may be changed instantly while the motor is running at full speed and under

full load. All gears are constantly in mesh, and in no way can the operator injure the unit by changing speeds at any time.

This gear unit is mounted on a standard squirrel-cage Westinghouse induction motor. In the gear unit, a pinion mounted on the motor shaft drives a gear mounted on the countershaft. Also on the countershaft are four idling ring gears which are constantly in mesh with four gears that are pressed on the output shaft. Each of the countershaft gears is provided with an internal clutch which is made to fit the bore of the gear. The clutch is actuated by two tapered wedges which are forced between the clutch halves by a spring member. To bring this member to the correct position for a desired speed, the control handle, which is provided with a spur pinion, is rotated, actuating a rack which is mounted on the spring member. This movement brings the spring member between the tapered wedges, thereby providing the pressure for clutching any one of the four ring gears to the countershaft, which in turn drives the output shaft at the desired speed.

For Small Drives.

A series of three small worm-gear speed reducers for small electric-motor drives up to seven-horsepower capacity were offered by the W. A. Jones Foundry & Machine Co., Chicago, Ill.

These small reducers are almost identical with the heavy-duty Jones worm-gear speed reducers except in size. The worm is made from a low-carbon, nickel-steel forging that is hardened to increase strength and



James vertical-type speed reducer.

wearing qualities and to provide for a low coefficient of friction. The wheel is made of a special nickel-phosphor-bronze alloy. The gear blank is dry sand cast and chilled, producing a casting of exceptional strength and load-carrying capacity with a minimum of friction. The teeth are generated to a very high degree of accuracy by specially designed hobs. The gear shaft, a high-carbon-steel forging, extends out on both sides of the housing.

Vertical Beaver-Gear Type.

A new speed reducer of the vertical spiral-bevel-gear type was announced by the D. O. James Manufacturing Co., Chicago, Ill.

This unit features smooth, noiseless operation and several novel advan-

tages of design. The gears are made of chrome nickel of the spiral-bevel type to obtain greater efficiency from the improved tooth-form which provides more teeth in constant contact and a greater tooth bearing or pressure area in each tooth of given size. High efficiency is thus provided and a greater delivery of input power.

Where large ratios of reduction are required this type of reducer is made integral with a planetary reduction unit so that all ratios from 8 to 1 to 1,600 to 1 are available. They are made in sizes from $\frac{1}{2}$ to 100 hp.

A well-designed housing prevents oil leakage and keeps dust and dirt from filtering into the unit, forming a neat, compact drive for use whenever vertical (up or down) driving is required.

Offers Worm-Geared Series.

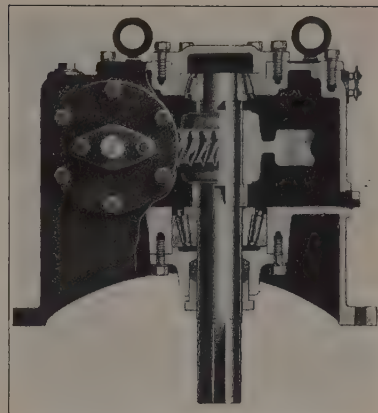
The Palmer-Bee Co. of Detroit, Mich., whose herringbone-gear speed-reducers are well and favorably known in the pit-and-quarry industries, began marketing a line of high efficiency worm-gear reducers.

The design of the Palmer-Bee machines has as its foundation the idea that mechanically-correct contact and perfect lubrication are the real essential requirements for high-grade worm gearing. To secure such contact and lubrication, it is necessary to produce a specific thread contour on the worm and a specific reverse contour on the wheel teeth. Both contours must be developed from the same basic curve.

Mathematical calculations show that the basic curve is neither a straight line nor an involute. Ordinary worms have straight-sided teeth. Ordinary worm wheels have involute teeth. Neither the worm nor the worm wheel has the correct form.

Anti-Friction Shaft Bearings.

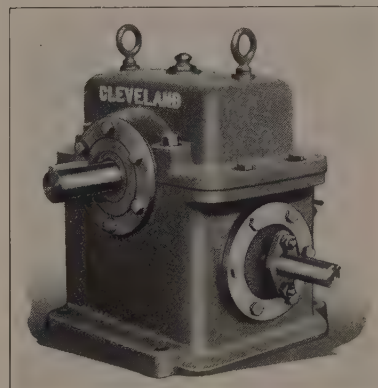
A 1931 addition to the series of standard worm-gear reduction units manufactured by the Cleveland Worm & Gear Co., Cleveland, O., is designed to transmit up to about $7\frac{1}{2}$ hp., the capacity depending on the reduction ratio and worm speed. The new size of unit is furnished in both horizontal and vertical types, and is designated size 70. The horizontal units are built with the worm below or above the gear, designated type AT or RT, re-



Palmer-Bee worm-gear speed reducer.

spectively. In the type VT vertical the gear shaft extends upward, the gear shaft of the type VD extending downward. The type AT is shown in the accompanying illustration.

All shafts of the size 70 Cleveland unit are mounted in anti-friction bearings, the gear shaft mounting of the vertical type being such that the unit will withstand an external axial thrust downward of 2,000 lb. The worm and its shaft are made from a single



Cleveland Type A reducer.

nickel-alloy steel forging, carburized, heat-treated, hardened, and ground all over to a high degree of accuracy. The gear is hobbled from a solid chill-cast, nickel-bronze blank. All grinding and hobbing operations are carefully checked by means of accurate standards and gauges. The worm thread is of the automotive type with a high pressure angle, giving maximum efficiency and dependability in service.

In a range of nine standard ratios, varying from 4%:1 to 60:1, the size 70 unit can be shipped immediately from stock. A list of fifteen special ratios is also available, the cost of a special ratio being slightly higher and delivery a little longer.



Jones worm-gear speed reducer.

Concrete Carriers Automatic Dumping Body.

The Cementank is a new Blaw-Knox product for the transportation of pre-

mixed concrete, being a steel cement container for batch trucks where the cement is proportioned into compartment trucks at a central plant, and then hauled to the paver or mixer.

It is of all-steel welded construction, moisture-proof, equipped with a top cover and a discharge door which opens automatically when the compartment is dumped. The Cementank requires absolutely no attention on the part of the operator, the cement empties by gravity and flows with the aggregates into the skip of the mixer. Arching of cement is prevented by the shape of the tank and its method of discharge.

The discharge door is flashed with felt to prevent leakage of cement. Locking of the end gate or truck partition automatically locks the discharge door of the carrier.

The Cementank has a capacity of 10.35 cu.ft., which is ample to take care of a seven-bag batch. It is 2 ft., 5½ in. high and 4 ft., 11¼ in. wide.

An Open-Top Carrier.

Recognizing the revolutionary advantages which the traveling-mixing method offers in concrete construction, and at the same time aware of all the problems it presents, the Leach Co. of Oshkosh, Wis., after two years of rigorous field testing, developed a new type of truck mixer.

An open top is one of the big advantages claimed for the Leach Travel-Mix, as the new carrier is called. It allows the entire batch to be dumped from the hoppers instantaneously.

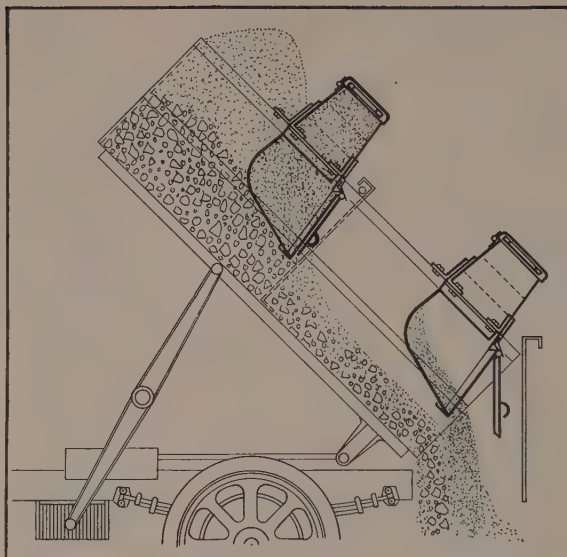


Diagram of Cementank body in dumping position.

This, the Leach Co. claims, is an important advantage over truck mixers which must be loaded through the end or, more generally, through a hole in the center of the drum—both of which necessitate careful aligning with the bin chute before dumping and usually considerable rocking of the drum before the entire load can be accommodated. The open-top also permits easy inspection of the batch at any time.

The first and most important requirement of any concrete mixer is, of course, to get a thorough mix in as short a time as possible. By revolving in opposite directions—the two padded mixers keep the aggregates passing from one trough to another across the center; and, in addition, the mixture is worked back and forth from one end of the mixer body to the other, alternating from one trough to the other.

The mixer, being driven by the engine of the truck, naturally requires

some reduction in speed. A simple gear reduction, inclosed in an oil-type case like a regular automobile-type transmission, is provided for this purpose. All gears are properly hardened.

Combined Mixer and Agitator.

The National Equipment Corp., Milwaukee, Wis., with a background of over thirty years' experience in designing mixers for every type of concrete work, announced the Smith truck mixer and agitator. This unit, incorporating many points of unique design, has the following important features:

A thorough five-step mixing action, accomplished by clock-wise rotating and *without reversing direction*.

Distinctive egg-shaped drum with twelve-sided panel design.

Full control of discharge—fast, slow or intermittent. Positive discharge—no hoisting or tilting of the drum.

Adaptable to any make of truck of sufficient capacity.

Separate power unit providing longer life of truck and better control.

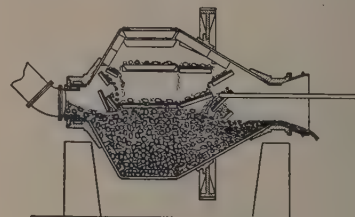
Roller and ball bearing drum support.

Simplicity and ruggedness of design—saving of weight and unnecessary mechanism.

Other Developments

A Conical Scrubber.

The Hardinge conical scrubber for washing stone, sand and gravel has been developed primarily in the Florida phosphate pebble field for removing clay balls and other matter from phosphate pebble. The scrubber is



Hardinge conical scrubber.

excellently adapted to the scrubbing of stone, sand and gravel for standard stone and sand-and-gravel plants where it is necessary to wash the stone, sand or gravel prior to shipment. The primary advantage of the Hardinge conical scrubber is two-fold. The material is made to scrub itself, owing to the superincumbent weight of the mass in the scrubber, and the fact that the conical scrubber operates at several times the speed of ordinary screens or other types of washers used heretofore. The action is very thorough and, as the material washes itself, the wear is next to nothing. The device used is similar in construction to the well known Hardinge conical mill which has been used for grinding ores and other materials for a good many years. Refinements in design and in the position of flights inside the scrubber, as well as special washing screens on the end, have been



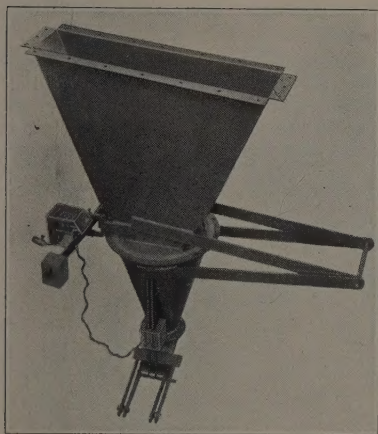
The Leach Travel-Mix concrete-mixing truck.

adapted to make this device particularly suitable in the stone, sand-and-gravel industries, where an efficient, but very low operating cost device must be employed to meet ever increasing competition in price as well as specifications of the product delivered.

Magnetic Flume Valve.

The Eagle Iron Works developed a new magnetically-operated flume valve for sand classification which is highly positive in its action. It is not dependent on counterweight action to open the valve, and exhaustive tests have shown that if necessary it will handle aggregate up to $\frac{1}{2}$ in. size.

The new flume valve is made up in two parts connected by a rubber diaphragm. The upper chamber is stationary while the lower has a vertical movement governed by the weight of



Eagle magnetic flume valve.

sand that has settled in it. The action is as follows:

When the lower chamber is depressed to a certain point the movement closes an electric switch which operates a magnetic solenoid, which gives a vertical pull to the gate over the discharge opening, which is spouted for side discharge at the bottom of the lower chamber. The solenoid holds the valve gate open for discharge until the switch is opened and current cut by the upward movement of the enlightened sand-settling chamber. The gate is weighted and drops into place as soon as the current is cut and the pull of the solenoid released. Thus, by adjustment of the lever operating the switch, the flume valve may be made to discharge at whatever point is desired in the filling, and likewise may be closed wherever it works to best advantage in the emptying of the tank.

Heretofore the counterweight operated flume valves have been limited to handling fine sand, were subject to sticking at times, and were not sure enough in their operation. In the new electrically-operated flume valves these handicaps have been overcome.

Improved Skip Hoists.

The Fairfield Engineering Co., Mar-

ion, O., in order to increase its services to users of material-handling machinery, is now manufacturing a complete line of skip hoists and allied equipment.

Fairfield skip hoists are available in capacities from 5 to 300 tons per hour. The bucket sizes range from 10 to 150 cu. ft. with speeds ranging from 50 to 300 ft. per min. The hoists are built with unbalanced, counter-weighted or balanced-type buckets and with either full automatic or semi-automatic control.

To meet every condition of service, Fairfield also designed and built two distinct types of automatic loaders—the weight-operated type automatically controlled by material weight, and the bucket-operated type designed for general purpose work. Each type loader has its own particular field.

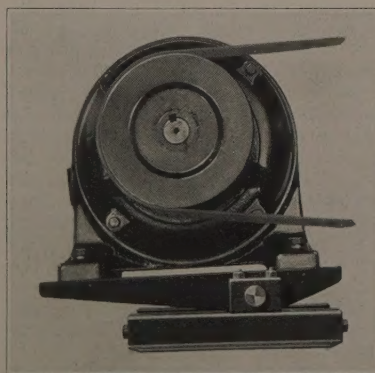
The winding machine being the heart of the skip-hoist installation, great care has been taken with the design of this unit. All shafts are made of alloy steels. The pinions, instead of being separately mounted, are cut on the shafts. All gears are made from alloy-steel blanks, the high speed gear set being herringbone and the balance cut spur.

Anti-friction bearings are used throughout. The lower portion of the base and the bearing pedestals are cast in one piece, assuring permanent alignment. All gears run in oil and are enclosed in a cast iron housing, and oil seals are used to prevent leakage.

Short-Center Drive.

The floating-motor-drive base, manufactured by the Kritzer Co., Chicago, is revolutionary in principle and comprises a motor base of pressed steel which when incorporated in a belt drive, either flat belt or V-belt, automatically regulates belt tension by utilizing motor torque.

The motor is mounted on adjustable pivoted arms permitting torque reaction to govern the actual amount of belt tension required. The base is designed and adjustment provided so that the motor may be positioned upon the arms to afford the minimum required initial tension position and consequent minimum bearing pressures.



Kritzer floating-motor drive.

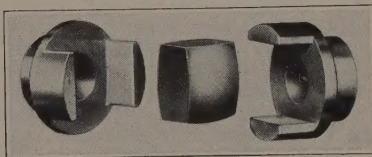
Torque reaction is a definite inherent characteristic of a motor and allows the regulation of belt tension with results unqualifiedly superior to any other tensioning device. The heavier the load on the belt the greater the torque reaction and tension. Conversely, the lighter the load on the belt the lighter the torque reaction and tension.

The floating-motor-drive principle of "utilizing motor torque to regulate belt tension" directly proportions tension to load and speed. Stock bases range up to 100 hp.

Small Flexible Couplings.

A 1931 addition to the line of flexible shaft couplings, manufactured by the American Flexible Coupling Co., Erie, Pa., includes two small sizes with maximum bores of $\frac{3}{4}$ in. and 1 in. and designated No. 4 and No. 6 respectively. In general design and kinematic action the small couplings are the same as the larger couplings manufactured by this company.

The flange sections of the small American couplings are die-cast. A wide groove is formed in the face, leaving two jaws between which the floating center member slides, as shown in the accompanying illustration. The floating center member is a solid, nonmetallic, self-lubricating



Small flexible coupling.

piece and transmits the torque between the flange sections. The design is simple and the coupling permits comparatively large misalignment between shafts, without the use of springs, bolts, pins or flexible materials.

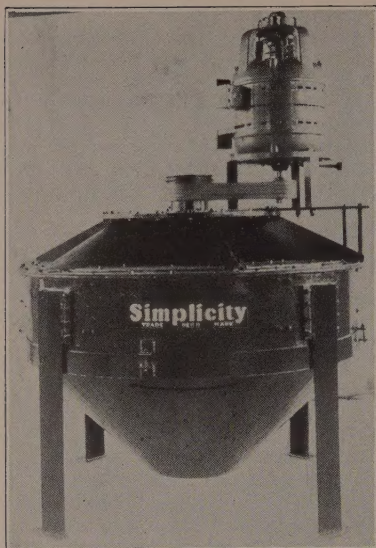
The power capacity is .05 hp. per 100 r.p.m. for the No. 4, and .15 hp. per 100 r.p.m. for the No. 6. The weights are $\frac{3}{4}$ lb. and 2 lbs. respectively. Both sizes permit a maximum parallel misalignment of $\frac{3}{64}$ in. and a maximum angular misalignment of 1 degree. The standard flanges are provided with a single setscrew, but additional screws or keyways can be provided.

Eliminates Non-durable Material.

The Simplicity Engineering Co. announced its latest development, the Simplicity D'centegrator. This machine was designed primarily for the purpose of eliminating non-durable material from gravel.

This result is secured by breaking the non-durable material through impact created by centrifugal force. After passing through the machine, the gravel is screened over a Simplicity gyrating screen to remove the fines, which contains the non-durable material to be eliminated.

The D'centegrator contains less than



The Simplicity D'centegrator.

twenty wearing parts, and these can all be easily and quickly replaced at a low cost per ton of material handled. These wearing parts are made of abrasive resisting material in order to provide maximum wearing life.

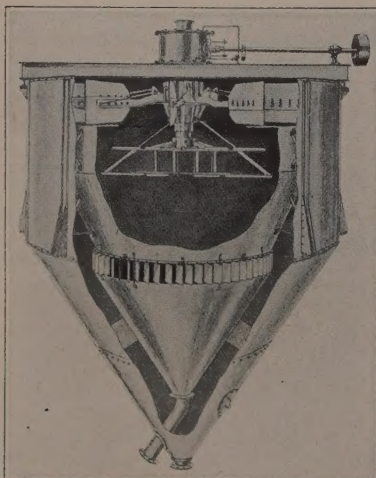
The D'centegrator has proved more than successful under actual operating conditions in a number of plants as well as in many factory tests.

A 15 hp. multi-speed motor with automatic push button control, supplies all the power necessary to handle 100 to 150 tons of gravel per hour in the No. 36 D'centegrator.

The D'centegrator can also be used as a secondary crusher, the only change required being a higher rate of speed. The crushed product is 100 per cent. cubical with all slabs and splinters being eliminated even when crushing slabby rock. Large tonnages and comparatively small horsepower are some of the chief advantages.

Improved Air Classifier.

The wide adoption of closed-circuit grinding in the modern cement plant



Open view of Bradley air classifier.

has created a demand for a thoroughly reliable separator of the air type, capable of dealing with heavy tonnages and operating at high efficiency.

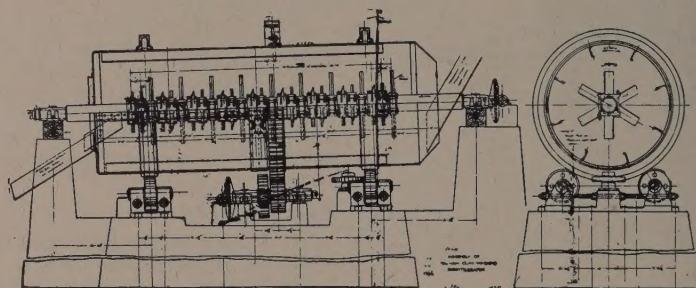
In response to this demand, the Bradley Pulverizer Co. in 1931 brought out the improved Bradley air classifier which, from the standpoint of mechanical construction, reliability and high-efficiency performance, is said to be superior to any piece of apparatus of this kind hitherto offered.

By means of this classifier finenesses up to 300-mesh or finer may be obtained when used in connection with any suitable pulverizer.

It is built in various sizes up to and including the 18-ft. machine.

Neutralizer for Washing Stone.

Demand for a cleaner stone is causing many producers to provide for washing their materials. In many cases as high as 1,000 gals. or more of water per min. is required. Therefore, Kennedy-Van Saun Manufacturing & Engineering Corp. developed a neutralizer which does everything that a log washer can do with approximately 20 per cent. of the power required to do the same work. As the

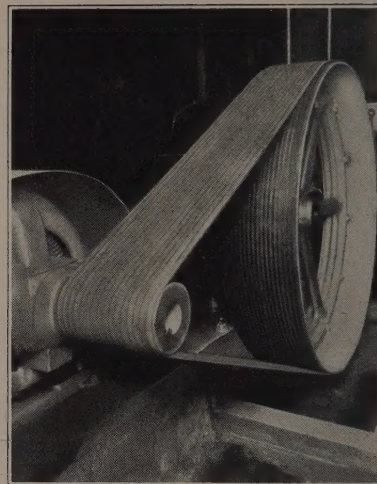


Sketch of Kennedy-Van Saun neutralizer.

stone is being discharged from the neutralizer a spray of water rinses the neutralized clay from the rock, enabling the producer to wash the stone without consuming large quantities of water. Large tonnages can be handled in one machine for taking care of the entire production of a large plant, which means little installation space. The blades in the center of the machine are revolved counter-current to the revolving drum on the neutralizer. The power consumption is low since the revolving drum is carried on roller bearings. In other words, it is an anti-friction washer of large capacity, low power consumption, and requiring small amounts of water. The reason for this small amount of water is that there is always a bath of water maintained in the revolving drum and the stone is agitated in the water so that the clay becomes neutralized without high pressure, the stone being lifted into the discharge spout much the same as stone is lifted into the discharge spout of the concrete mixer, except that, in the case of the neutralizer, the discharge is stone.

Modernized Rope Drives.

Vulco rope V-Flat drives, a 1931



Vulco rope V-belt drive.

product of the Gates Rubber Co., Denver, Colo., are suitable for almost all power transmission requirements, especially those where high speed ratios and short shaft centers are desirable.

Old flat belt, gear and chain drives may be modernized with little expense. Usually the equipment needed for such conversion will be the motor sheave and the necessary Vulco ropes, since the old flat pulley (or gear or sprocket fitted with a flat steel band) will serve satisfactorily as the drive pulley. If not, a flat pulley of proper size can generally be obtained at a low cost.

The pump drive shown is a typical V-Flat application. Only a small cost was involved in purchasing the motor sheave and V-belts to make this conversion.

Refractories for Cement Mill and Lime Plant Service.

The most noteworthy 1931 development in the use of refractories in the cement industry has been the more general use of high-alumina blocks or liners in the burning zone of rotary kilns for burning Portland-cement clinker. This is largely attributable to the advances in the manufacture of Portland cement and the appreciably increased production per unit of equipment. With harder burning of the clinker, higher temperatures have become necessary and a point

has been reached where the first-quality fireclay brick, formerly generally regarded as standard for burning zones, are not sufficiently refractory to meet the service conditions imposed upon them.

Liners of the 70 per cent. alumina class are now most generally used, although those of the 50 per cent. and 60 per cent. alumina classes have been widely adopted for less severe service conditions. In the burning zone of rotary kilns used for burning limestone too, high-alumina liners are replacing first-quality fireclay liners with excellent economy.

Much has been accomplished in prolonging the life of linings in coolers and driers by the use of special hard, dense brick. Such brick, however, should possess fairly high refractoriness which property appears to be definitely linked with the resistance which the brick offers to spalling caused by rapid temperature fluctuations.

There has been a very marked improvement in the workmanship of fireclay refractories as a result of the introduction of the power press process and a study of use of presses to best advantage. The power press process is now extensively supplanting the auger machine process, steam pressing and hand moulding.

Silica brick also are being made by machine under exceedingly heavy pressure. The physical properties of the brick have been considerably improved, almost in proportion to improvement in workmanship.

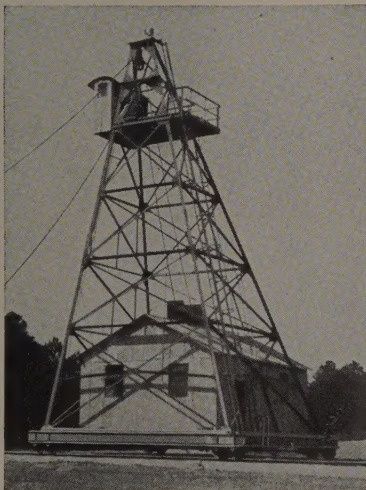
An exceptional magnesite brick of lower iron content but containing a considerably higher percentage of magnesia than is found in the usual standard magnesite brick has been developed by Harbison-Walker Refractories Co. It is especially suited for applications where it is necessarily exposed to direct heating as distinguished from the use of magnesite brick in open hearth and electric steel furnace practice where it forms the under structure and supports a working bottom consisting of dead burned grain magnesite sintered in place. This new magnesite brick possesses greater resistance to spalling, lower shrinkage, greater mechanical strength at high temperatures and a higher degree of basicity. Because of these pronounced advantages there seems to be no doubt that it will become more widely used in furnaces where a basic refractory is most nearly ideal for the service, as for example, in lime kilns and such other kilns used in burning raw materials or products in which the alkali content is comparatively high.

Refractory bonding mortars are contributing much to increased life of refractories in cement and lime kiln service, especially in the nose rings of wet process kilns, the nose and feed end rings of dry process kilns and in the hoods.

Towers for Drag-Scrapers.

Sauerman Bros., Inc., Chicago, counts among its important 1931 achievements in the field of new equipment, the designing of several improved types of steel head-tower for drag-scraper installations. These new towers tend to increase the speed and ease of operation and the handling capacity of the large, mobile Sauerman scraper installations that are used in the pit and quarry field for storing and reclaiming materials and for stripping overburden.

The new towers have been designed so that the overturning movement is resisted with an ample factor of safety and yet the towers are not cumbersome in either appearance or action. The towers are self-supporting and self-propelling. For most projects, the tower is equipped with flanged wheels for travel on two lines of standard gauge track, but crawler mountings are furnished when the ground conditions make crawlers desirable. A reversible propelling engine is



Head tower for Sauerma scraper system.

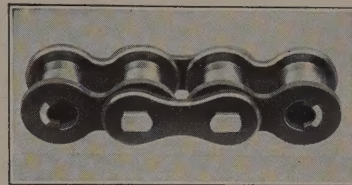
mounted on the tower platform together with the scraper power unit. The operator's cab is on an elevated platform extending from the tower framing, the operating levers being banked in the cab.

These towers have been designed in various heights and sizes to handle 2, 4, 6, 8, 10, 12 and 14 cu.yd. scraper buckets on 300 to 1,000 ft. operating spans.

Incidentally, Sauerma Bros., Inc., during the past year designed and built Crescent scraper buckets for the first time in 12 and 14 cu.yd. sizes, thought to be larger than any bottomless scrapers previously built. These huge buckets, however, were not for material producers but were installed on scraper-tower machines on Mississippi River levee construction.

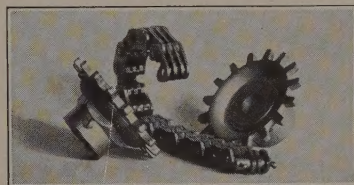
Morse Chain Developments.

The Morse Chain Co. of Ithaca, N. Y., during the year developed a new roller chain of distinctive joint construction, interchangeable on all



Morse Roller Chain.

standard roller sprockets. In this chain, no movement under load occurs between the roller and joint members, insuring uniformity of wear and smooth, quiet operation. The company also designed a midget coupling, an open view of which is shown in the accompanying picture. Other

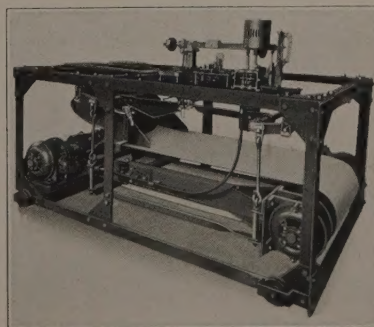


The Morse midget coupling.

Morse accomplishments include a "pumpkin-seed" chain for driving the spindles of modern precision grinders and an improved standard A-type flexible coupling provided with a split aluminum cover.

Continuous Weighing with Light-Sensitive Scales.

The Telepoise, produced by John Chatillon & Sons, New York, N. Y., is finding many applications where bulky materials must be weighed while in motion. Earlier models made use of a mechanically-actuated electrical-contact member vibrated against a contact drum, with a given number of contacts per revolution of the fluted cylinder actuating the contact member. The contact drum, on the other hand, has half its surface conductive and the other half insulated, the dividing line between the two surfaces being a true helix. The electrical contact member freely moving up and down on the



Telepoise scale with "electric-eye" totalizer.

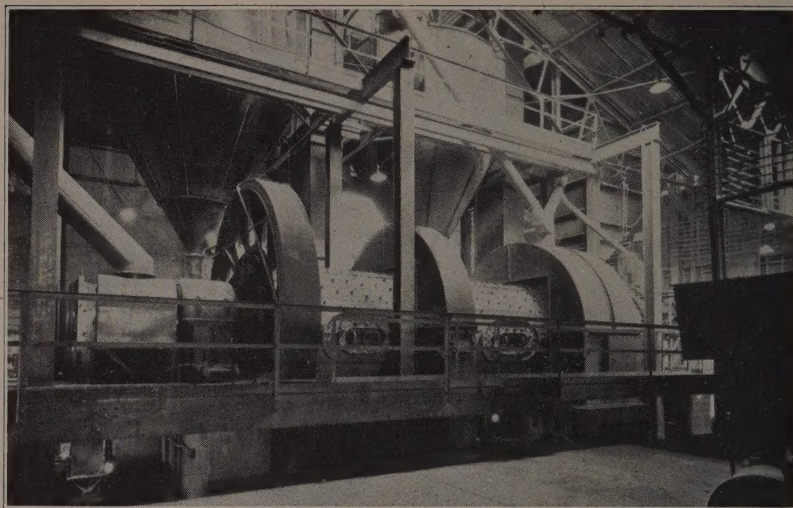
conductor-insulator drum in accordance with the position of the scale beam, transmits more or fewer electrical impulses per revolution of that drum because of the varying proportion of conductive to insulated surface at any given point longitudinally speaking. The present arrangement, utilizing a chopper cylinder, light source and light-sensitive cell, is simpler, easier to adjust and more economical.

The electrical impulses produced by means of the light-sensitive cell, as the result of the interrupted beam of light, are amplified by means of a two-stage amplifier. The output operates a Burgess vacuum-contact relay, capable of handling all the current required for the operation of one or more integrators or counters located at any distance from the scale. The integrators are simple electro-magnetic devices somewhat similar to the mechanism of stock tickers, fire alarms, printing telegraphs, etc. The received impulses actuate armatures which are geared with the numeral dials of a register. The integrators are calibrated in short, long or metric tons, pounds, barrels or other desired units.

While the scale and light-chopper have been developed by the engineering staff of John Chatillon & Sons, the light and amplifier details are the work of the Burgess Battery Co. engineers.

Crushing and Cement-Making Machinery.

During 1931 two large Compeb mills were built and put into operation for dry grinding of raw materials by the Allis-Chalmers Mfg. Co. The capacity of these mills materially exceeded expectations and demonstrated the value



Dry grinding, 3-compartment Compeb mill at Missouri Portland Cement Co. plant.

of the circuit under which they operate. These mills are 9½ ft. in diameter in the preliminary compartment and 8 ft. in diameter in the finishing compartments. Both have three compartments, one of which is 35 ft. long, the other being 40 ft. long over-all. The air-separator circuit consists of classifying the material discharged from the first compartment with the production of finished material and a coarse reject which is sent to the second compartment. The second air separator classifies the material discharging from the second compartment and produces finished material. Rejects are passed to the third compartment which is operated in open circuit. In one case provision was made to send the material discharged from the third compartment

to the air separator if it was so desired. With the use of this circuit the circulating load of fine material has been eliminated with resultant economies in operation. The 9½-ft. Compeb-mill installation of the Missouri Portland Cement Co., Independence, Mo., plant is shown here.

New Officials Appointed by General Refractories

At a meeting of the board of directors of the General Refractories Co., Philadelphia, Pa., held December 28, 1931, the following appointments were made: F. L. McManus, vice-president in charge of traffic; D. M. Thorpe, vice-president in charge of sales; and L. Tschirky, vice-president and assistant to president.



An outstanding development by F. M. Welch Engineering Service, Inc., of Greenville, O., in 1931 was the revolving portable stacker pictured above, designed and built for the Medusa Portland Cement Co. The machine, equipped with a 36-ft. belt conveyor on 160-ft. centers is mounted on three crawlers and is self-propelling. It is fed by a 3-cu.yd. shovel, handling about 300 cu.yd. of overburden per hr., the dirt being deposited at the bottom of the quarry.